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158419

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DRAFT WORK PLAN FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY, DEAD CREEK PROJECT SAUGET/CAHOKIA, ILLINOIS

February 1986

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY,
DIVISION OF LAND POLLUTION
2200 Churchill Road
Springfield, Illinois 62706

ecology and environment, inc.

195 SUGG ROAD, P.O. BOX D, BUFFALO, NEW YORK 14225, TEL. 716-632-4491

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TABLE OF CONTENTS

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Table of Contents (Cont.)

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LIST OF ILLUSTRATIONS

EXECUTIVE SUMMARY

This Work Plan was prepared pursuant to the contract issued by the Illinois Environmental Protection Agency (IEPA) to Ecology and Environment, Inc., (E & E) to conduct a Remedial Investigation/ Feasibility Study (RI/FS) in the Dead Creek area in the towns of Sauget and Cahokia in St. Clair County, Illinois. The project area specifically includes various sites in the two towns that were used for industrial waste dumping or as landfills, as well as portions of Dead Creek--a stream that traverses through the project area before flowing into the Mississippi River. The project will be conducted in cooperation with the IEPA Division of Land Pollution Control.

The Work Plan presents a comprehensive approach for performing the field investigations and technical evaluations required to complete the RI/FS. In particular, this report includes a sampling plan for subsurface, groundwater, surface water/sediment, and air sampling in the project area; a site-specific health and safety plan; a Quality Assurance Project Plan (QAPP); a community relations plan; and a permitting requirements plan. The Work Plan also specifies the approach for completing the 11 tasks that comprise the preliminary and primary phases of the Remedial Investigation (RI) and the nine tasks that comprise the Feasibility Study (FS). The technical approach described in this plan was developed based on a thorough review of existing data concerning the project area.

The entire RI/FS is scheduled to be completed in 75 weeks. The total cost for the project is expected to be approximately $1,012,000.

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1. INTRODUCTION

This Work Plan describes the scope of activities that will be performed for the Remedial Investigation/Feasibility Study (RI/FS) for the Dead Creek Project in the towns of Sauget and Cahokia, St. Clair County, Illinois. The project area includes 18 sites of known or suspected contamination, including portions of Dead Creek--a stream which traverses through the project area before flowing into the Mississippi River. Figure 1-1 shows the project location and the sites.

The plan provides a comprehensive approach for implementing the various RI/FS tasks and will serve as a guide for the overall management of the project. The plan specifically incorporates the requirements of the Professional Services Agreement, executed September 9, 1985, between the Illinois Environmental Protection Agency (IEPA) and Ecology and Environment, Inc., (E & E); the IEPA Request for Proposal, dated April 3, 1985; and the E & E proposal, dated May 20, 1985.

The Dead Creek Project will be conducted in two phases--the RI phase followed by the FS phase. The overall purpose of the RI/FS for the Dead Creek Project is to:

- o Assess the cause, extent, and effects of the hazardous materials in the project area;
- o Identify and evaluate alternatives to remedy contamination problems that pose threats to the environment or to public health, as determined by the fieldwork conducted during the RI; and

- Recommend remedial alternatives on a site-by-site basis.

The RI will be oriented toward the compilation of data needed to assess the type and location of hazardous materials at each site and subsequently to evaluate feasible alternatives to eliminate the materials as sources of environmental contamination (i.e., to support the FS phase). The specific objectives of the RI are to:

- Identify the locations of hazardous materials at each of the sites;

- Define the types and quantities of hazardous materials identified at each site;

- Describe past, present, and anticipated methods of contaminant release;

- Define the contaminants released to the environment;

- Determine the movement of contaminants in different matrices, including:

  - Present extent of contamination,
  - Direction of movement,
  - Rate of movement,
  - Evaluation of exogenous factors influencing movement, and
  - Extrapolation of future movement factors.

- In coordination with IEPA, to the extent possible, locate sources of hazardous wastes and identify responsible parties; and

- Based on the data compiled, evaluate the long-term impacts of contaminant releases, both present and potential, at the various sites.

To achieve these goals, the RI work effort will involve a review of existing data and an evaluation of current site conditions, as well as the performance of a field sampling and analysis program (for surface soils, subsurface soils, surface water, stream sediment, groundwater, and air). The 11 tasks that comprise the RI are described in Section 3, and include:

- Task 1 - Initial Meeting
- Task 2 - Work Plan
- Task 3 - Associated Support
- Task 4 - Additional Data Gathering - Existing Data Review and Evaluation
- Task 5 - Description of Current Situation
- Task 6 - Preliminary Report
- Task 7 - Site Investigations
- Task 8 - Preliminary Remedial Technologies
- Task 9 - Site Investigation Analysis
- Task 10 - RI Reports (Draft/Final)
- Task 11 - Additional Requirements

The primary objective of the FS will be to develop a cost-effective, comprehensive remedial action plan for each site, utilizing the data developed during the RI. In particular, the specific objectives of the FS are to:

- Identify remedial technologies applicable to the project area and to specific sites within the area;
- Screen and evaluate remedial alternatives for each site; and
- Prepare a conceptual design for a recommended remedial alternative or alternatives on a site-by-site basis.

In accordance with IEPA guidelines, an underlying objective of the FS is to identify remedial technologies and alternatives that will utilize "high-tech" methodologies wherever ~~possible~~. feasible

The FS includes nine tasks. These tasks, which are discussed in Section 4, are as follows:

- Task 12 - Description of Proposed Response
- Task 13 - Development of Alternatives
- Task 14 - Initial Screening of Alternatives
- Task 15 - Laboratory Studies
- Task 16 - Evaluation of Alternatives
- Task 17 - Draft FS Report
- Task 18 - Conceptual Design
- Task 19 - Final FS Report
- Task 20 - Additional Requirements

This Work Plan will be the primary planning instrument for the implementation of the various RI/FS activities. The plan provides background information relating to the RI/FS; guidelines for all sampling and analytical procedures conducted as part of the RI; and detailed descriptions of the various RI/FS tasks. In addition to the RI/FS task descriptions, included in Sections 3 and 4, respectively, the plan summarizes the project background (Section 2) and outlines the project schedule (Section 5), management (Section 6), and budget (Section 7). The detailed plans to insure the timely completion of the project in a high-quality manner, and in accordance with applicable health and safety, sampling, and analytical protocol are included in appendices.

- o Illinois State Geological Survey published and open-file reports;

- o Illinois State Water Survey published and open-file reports; and

- o U.S. Army Corps of Engineers (St. Louis Regional Office) published reports and open-file data.

A number of locations within the project area were initially developed as sand pits (Sites G, H, I, and M) and the excavations were subsequently filled in with a variety of unknown materials, including wastes from sources in the towns of Sauget, Cahokia, and the East St. Louis area. According to the St. John report, the contamination of Dead Creek was likely due to tank truck residues and washout materials that were discharged by Harold Waggoner Trucking Company and, subsequently, Ruan Trucking Company. Additionally, potential sources of contamination in Dead Creek include the following:

- o Discharges from the Midwest Rubber Company, which utilized an effluent pipeline leading from their factory to the creek. This pipeline was removed sometime in the mid-1960s.

- o Discharges from the holding ponds at Cerro Copper Products Company. Prior to the sealing of a culvert beneath Queeny Avenue, these ponds were headwaters for Dead Creek. At that time, the ponds received discharges from Cerro Copper, and Monsanto Chemical Company.

- o Groundwater discharges from past disposal pits/landfills in the vicinity of the creek.

The IEPA became aware of the project area in May 1980 as a result of a problem with periodic smoldering of materials in a ditch (Dead Creek). The problem did not appear to be serious until, in August 1980, a local resident's dog rolled in the ditch and died of apparent chemical burns. IEPA subsequently performed preliminary soil and water sampling to determine the conditions in the ditch. The soil in the ditch was found to contain high levels of phosphorus, heavy metals, and polychlorinated biphenyls (PCBs). As a result, the IEPA restricted access to the area. This involved the installation of 7,000 feet of snow fence around the ditch and the pond between Queeny Avenue and Judith Lane. According to IEPA, soils and groundwater were polluted in the area, and a detailed study would be needed to assess the extent of pollution.

A brief description and history of each of the sites and creek segments within the project area is provided below. The alphabetic site and creek segment designations used below will be used for all reports, maps, and other deliverables.

2.1.1 Dead Creek

Within the project area, Dead Creek flows southwest through the towns of Sauget and Cahokia and discharges into the Prairie DuPont floodway. The floodway in turn discharges into the Cahokia Chute of the Mississippi River. In general, Dead Creek is a small (8 to 10 feet wide), intermittent stream which serves as a conduit for drainage from the American Bottoms Area in St. Clair County. The hydrology of the creek is not well-defined, and will be assessed in this project. Water depth in the creek varies, and is entirely dependent on seasonal fluctuations. Six segments of Dead Creek have been designated within the project area. These are defined as follows:

- Creek Sector A - Dead Creek north of Queeny Avenue;
- Creek Sector B - Dead Creek between Queeny Avenue and Judith Lane;
- Creek Sector C - Dead Creek between Judith Lane and Cahokia Street;
- Creek Sector D - Dead Creek between Cahokia Street and Jerome Lane;
- Creek Sector E - Dead Creek between Jerome Lane and the culvert north of Parks College; and

o Creek Sector F - Dead Creek south of the culvert at Parks College to the discharge point into Prairie DuPont floodway.

Creek Sector A consists of the holding ponds at Cerro Copper Products Company. Discharges to these ponds are presently limited to surface drainage and roof drainage. Land use in the vicinity of Creek Sector B includes industry (northern portion) and agriculture-cultivated fields are located on both sides of the creek in the southern portion of Sector B. The remainder of the creek flows through residential/commercial areas in the Town of Cahokia.

2.1.2 Sites

There are 12 sites of known or suspected contamination within the project area. These sites have been classified alphabetically, and are briefly described below.

Site G - IEPA Sites 1 and 2

The examination of historical photographs revealed that waste disposal operations at this site began in approximately 1955. Prior to that time, the area was used for agricultural purposes. No information has been found concerning past operators or sources of disposal for this site. Drums containing a black cinder-like solid have been observed at the surface, as have pits containing oily wastes. In addition, the site has been used extensively for the surface disposal of general waste. Originally, IEPA Site 1 was considered to be the area of previous waste disposal; IEPA Site 2 was the surrounding area. However, since the area between the sides was undefined, the two were combined for the RI.

Site H - IEPA Sites 3 and 4

This site was a former sand and gravel pit, which was filled with construction debris and other wastes. Monsanto Chemical Company notified USEPA in 1981 that drums of solvent, other organics, and inorganics were buried on-site. Waste disposal occurred on-site from about 1944 until 1957. Prior to 1940, the area delineating Site H was a cultivated field, contiguous with the field to the south which is still used for agriculture. The initial purpose of excavation at Site

H in the early 1940s was to obtain sand for the construction of roads, as wartime demand had significantly increased industrial activity in the area. Following World War II, surplus materials including chemicals and reportedly munitions were disposed of in excavated sand pits throughout the area. It is likely that municipal wastes from the towns of Sauget and Cahokia were also disposed of at Site H. The site has been covered, graded, and vegetated and is now inactive. Currently, the site is owned by Roger's Cartage Company. IEPA Site 3 was the actual disposal area and IEPA Site 4 was the surrounding area. Since there was no definite boundary between these IEPA sites, they were combined as Site H for the purposes of the RI.

Site I - IEPA Sites 5 and 6

The southern half of this site was contiguous with Site H until separated by the construction of Queeny Avenue. Disposal operations at Site I followed the same historical progression as outlined above for Site H. Cerro Copper Products Company purchased property west of Site I in 1957 from the Lewin-Mathes Company. In approximately 1962, Cerro added additional properties, including Site I, to their holdings. The site is presently covered with rip-rap and gravel, and is used by Cerro for equipment storage. Creek Sector A is located immediately west of Site I on Cerro Copper property. Since the only differentiation between IEPA sites 5 and 6 was historical progression, they were combined as Site I for the RI.

Site J - IEPA Site 7

Site J consists of an unlined pit and a surface disposal area utilized by the Sterling Steel Foundry Company. Sterling Steel began operations at this location in approximately 1922. The surface disposal area occupies a triangular piece of Sterling's property covering approximately six acres to the northeast of the plant building. Examination of historical aerial photographs indicate disposal activity in this area began sometime between 1973 and 1978. Wastes disposed at Site J include casting sand, demolition debris, and scrap metal. An unlined pit is located immediately south of the surface disposal area. Dimensions of this pit are roughly 50 feet x 50 feet. The pit was excavated in approximately 1950 for the purpose of collecting and allowing settlement of baghouse dust from the foundary furnace.

Additional areas of interest at Sterling Steel include a second unlined pit and an incinerator, which are not included in the present scope of work for this project. The pit, located southeast of the plant building, was excavated in approximately 1955 as a borrow area for road fill. The majority of the original excavation has since been filled with casting sand and scrap metal. The incinerator was used for burning plant trash from 1970 until approximately 1981.

Site K - IEPA Site 8

Historical photographs suggest possible waste disposal operations at this site. Excavation at the site began sometime in the late 1950s. No data have been generated for Site K, and the IEPA has no file information concerning the site. Since the excavation, the site has been covered and graded. At present, a trailer park and a small trucking company occupy the site.

Site L - IEPA Site 9

Historical photographs and IEPA file information indicate that a surface impoundment once existed at this site. Waggoner Trucking Company, an industrial waste hauler that specialized in hauling hazardous waste, used the site for washing trucks between 1964 and 1974. Initially, the wash water was discharged to Dead Creek. Waggoner was ordered by the IEPA to cease discharging wash water to the creek in 1971. Subsequently, the surface impoundment was excavated for the purpose of "storing" the wash water. However, since the impoundment was not lined, this practice constituted disposal of liquids potentially containing hazardous constituents. Waggoner sold the property and operations to Ruan Trucking Company in 1974. Ruan reportedly continued to use the surface impoundment until 1978. Metro Construction leased the property from Ruan in 1978 for the purpose of operating a heavy-equipment maintenance and repair shop. Metro subsequently purchased the property and covered the impoundment. Presently, the area is covered with cinders and is used for equipment storage.

Site M - IEPA Site 10

Site M consists of a former borrow pit which was used by the Hall Construction Company. The pit is located immediately east of Dead Creek, and contains water year-round. It is separated from the creek by a ridge; however, following heavy rains, overflow from the creek has been observed in the pit. The pit was excavated in the early 1950s, and was subsequently partially filled with unknown materials. A fence was installed around Site M concurrently with the restriction of access to Sector B of Dead Creek.

Site N - IEPA Site 11

Hall Construction Company occupies the property delineating Site N. Examination of historical photographs indicates a possible disposal operation was conducted at this site between the years 1955-1968. No data has been generated, and IEPA has no file information concerning this site. The excavated area has since been filled with unknown materials. Presently, Hall Construction uses the property for equipment storage.

Site O - IEPA Site 12

Site O consists of four covered lagoons which were formerly used for sludge dewatering by the Sauget Wastewater Treatment Plant. This practice occurred from approximately 1968 to 1978. These lagoons cover about 22 acres to the south of the treatment plant. Over 90% of the influent to the plant is from Sauget area industries. Effluent from the treatment plant has exceeded permit limitations continuously, dating from the early 1970s. Construction of a potable water line was initiated in 1983 in the area of the former lagoons. When workers complained of strong organic odors from excavations in the area, construction activity was halted, and the water line was subsequently rerouted. Presently, the lagoons are covered and vegetated, and an access road to the new American Bottoms Regional Treatment Plant has been constructed through the area.

Site P - IEPA Site 13

This site is an IEPA-permitted landfill. On several occasions between the years 1977-1981, IEPA inspectors noted hazardous waste pictures taken by IEPA during inspections of the facility. Drummed wastes were not segregated in any manner. A flood event was reported in 1973, at which time an earthen berm constructed to the west of the dump was washed out. The site has been extensively studied since its closure in 1977. A Monsanto feedstock tank farm is located adjacent to the site in the northwest corner. Presently the site is clay-capped and vegetated.

2.2 ENVIRONMENTAL SETTING

2.2.1 Geology

The Dead Creek project area is situated in the Mississippi River floodplain on valley deposits. The valley deposits consist of a thin mantle of Cahokia Alluvium, and thicker glacial outwash known as the Henry Formation.

The Cahokia Alluvium was derived from the erosion of till and loess, and consists of unconsolidated, poorly sorted silt with some local sand and clay lenses. In the Dead Creek area, the Cahokia Alluvium has a thickness ranging from 6 to 20 inches and a laboratory permeability on the order of 7×10^{-6} cm/sec. The Cahokia Alluvium rests uncomformably on the Mackinaw member of the Henry Formation. The Henry Formation is Wisconsin glacial outwash in the form of valley train deposits. It consists of a sequence of subrounded, moderately sorted sands and gravel, coarsening downwards. The Henry Formation has a thickness ranging from 100 to 114 feet and a laboratory permeability on the order of 4×10^{-3} cm/sec. Due to its thickness, permeability, and water capacity, the Henry Formation is a major aquifer for the East St. Louis area. The bedrock underlying the valley deposit is a limestone of Mississippian age (Figure 2-1).

2.2.2 Groundwater Occurrence

At most locations in the project area, Henry Formation sands, which rise to within 14 feet of the surface on the average, are the major aquifer. Exceptions occur in the northern and southern portions of the creek, where the silt mantle thickens and the groundwater level encounters it.

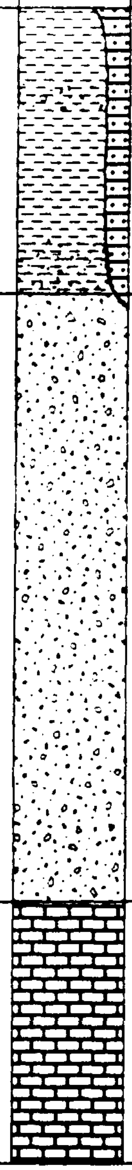
SYSTEM	SERIES	STAGE	FORMATION	COLUMN	THICKNESS (In Feet)	DESCRIPTION
QUATERNARY	PLEISTOCENE	HOLOCENE	CAHOKIA ALLUVIUM		6–20	SILT, LIGHT TAN, WITH CLAY AND FINE SAND LOCALLY, MICACEOUS.
		WISCONSINAN	HENRY		100–114	SAND, TAN, ARKOSIC, FINE GRAINED AT TOP COARSENING DOWNWARD TO INCLUDE SOME FINE TO MEDIUM GRAINED GRAVEL. SUBROUNDED, MODERATELY SORTED. CONTAINS: QUARTZ, CHERT, FELDSPARS, LIMESTONE, FERROMAGNESIAN MINERALS, SHELL FRAGMENTS; WOOD CHIPS AND COAL FRAGMENTS AT TOP.
		GROUP				
MISSISSIPPIAN	VALMEYERAN	MIDDLE VALMEYERAN			100+	LIMESTONE

Figure 2–1 GENERALIZED GEOLOGIC COLUMN FOR UNCONSOLIDATED DEPOSITS TO BEDROCK IN THE DEAD CREEK AREA

Water table conditions, as opposed to leaky artesian conditions, prevail at the site because the lower portion of the alluvial silt is permeable enough (5.4×10^{-3} cm/sec) not to impede vertical movement of the groundwater.

Potentiometric surface maps indicate that the hydraulic gradient is very flat in the project area. The gradient is 3 feet/1,060 feet, or .00283, generally moving to the west but with local fluctuations apparent.

2.2.3 Climate

The project area is located in the northern temperate zone which is characterized by warm summers and moderately cold winters. The average annual precipitation in the area is about 38 inches, based on data from Edwardsville, Illinois. The greatest amounts of rainfall occur from March through June. Then a gradual monthly decline occurs until December. With the average calculated evaportranspiration calculated at about 33 inches, the average potential water surplus is about 5 inches a year. Some of this surplus water infiltrates the soil and moves downward.

2.3 PREVIOUS INVESTIGATIONS

Previous investigative activities in the project area have included groundwater, surface water, sediment, surface soil, subsurface soil, and air quality sampling. These investigations include the following:

- IEPA - Preliminary Hydrogeologic Investigation in the Northern Portion of Dead Creek and Vicinity, April 1981, (St. John Report).

- USEPA Field Investigation Team (FIT) - Soil Sample Results for Chemical Contamination Below Sauget/Sauget Landfill in Sauget, Illinois, December 16, 1983.

- IEPA - Illinois Air Quality Report, 1984, published in June 1985.

standards and background quality in every well. Lead, phenolics, sulfate, and zinc were above the standards in six or more wells.

PCBs were detected in three wells--G101, G102, and G110 (see Appendix A). Other organics detected, such as chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, cyclohexanone, and chloroanilines, were mostly associated with wells G107 and G112, although some other organics were also found in wells G102, G109, and G110. All of these organics were found in relatively high concentrations and were not found in the background wells. The organic and inorganic analyses discussed above demonstrate groundwater pollution in the area from various sources.

Among the wells, it appears that the groundwater in Well G109 is the most polluted; ammonia, arsenic, cadmium, copper, iron, manganese, nickel, pH, phenols, phosphorus, R.O.E, sulfate, and zinc exceeded the water quality standards by several times. Other parameters for which no standards exist were found at high concentrations. This well is located between Dead Creek and the former disposal impoundment (Site L).

Two wells, G112 and G107, exhibited concentrations of metals substantially above the state water quality standards. These wells are located downgradient of Sites I and G, respectively. The highest concentrations of organics were also detected in samples from these wells. In G107, two samplings have shown that chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, and chloroaniline are present. In G112, chlorobenzene, dichlorobenzene, and chloroaniline were detected. Other highly polluted wells include G110, G106, G105, G103, and G102 in which several inorganic parameters were found to exceed the background levels and the standards.

When compared to background levels, monitoring wells G101 and G104 indicate little evidence of pollution. This is probably due to the locations of the wells away from the pollution sources in the project area, and the attenuation of the chemicals over the long flow distance and time. Although Well G101 is located relatively close to the southwest corner of Site G (approximately 100 feet), both wells are located at least 400 feet from Dead Creek. Also, G101 and G104 are the only wells in the IEPA study which are located west of a large depressional area situated south of Site G. This area contains water during the majority of the year, possibly indicating groundwater discharge to the depression. This would reduce the likelihood of finding contaminants in these wells. Elevated levels of contaminants detected in Well G107, located immediately south of Site G in the depression, lends support to this possibility.

In addition to the preliminary hydrogeological investigation in the vicinity of Dead Creek, the IEPA has sampled monitoring wells at Site R which were installed by a contractor for Monsanto Chemical Company. The locations of these wells are shown on Figure 2-2, and the analytical results are presented in Tables 2-1 and 2-2. These results indicated the presence of high levels of organic contaminants in all wells sampled in 1979 and 1981. Organic contaminants detected include biphenylamine, chlorobenzene, chlorophenol, chloronitrobenzene, dichlorobenzene, dichlorophenol, diphenylether, phenol, and trichlorophenol. Aliphatic hydrocarbons were also detected, but were not specified. Several metals exceeded IEPA water quality standards in the 1979 sampling. These included copper, lead, manganese, nickel, and zinc.

Additional groundwater investigations are presently in progress at Sites O and R. A contractor for Monsanto is conducting these investigations, and no data have yet been released.

Surface Occurrence

The surface waters in the Dead Creek Project area which were sampled and analyzed by IEPA personnel include the holding ponds for Cerro Copper (Site I), the pond in the former Hall Construction Company sand pit (Site M), and the creek waters downstream from Judith Lane (Creek Sectors C through F). The locations of these samples points, as well as the analytical results of the sampling efforts, are included in Appendix A.

Surface Water Quality

Analysis of the Hall Construction Company (Site M) pond (sampling locations S501 and S502 in the St. John Report; see Appendix A) indicated that the water is somewhat polluted, with copper, phosphorus, and iron concentrations slightly above the water quality standards. PCBs were also identified (at 0.9 ppb and 4.4 ppb concentrations).

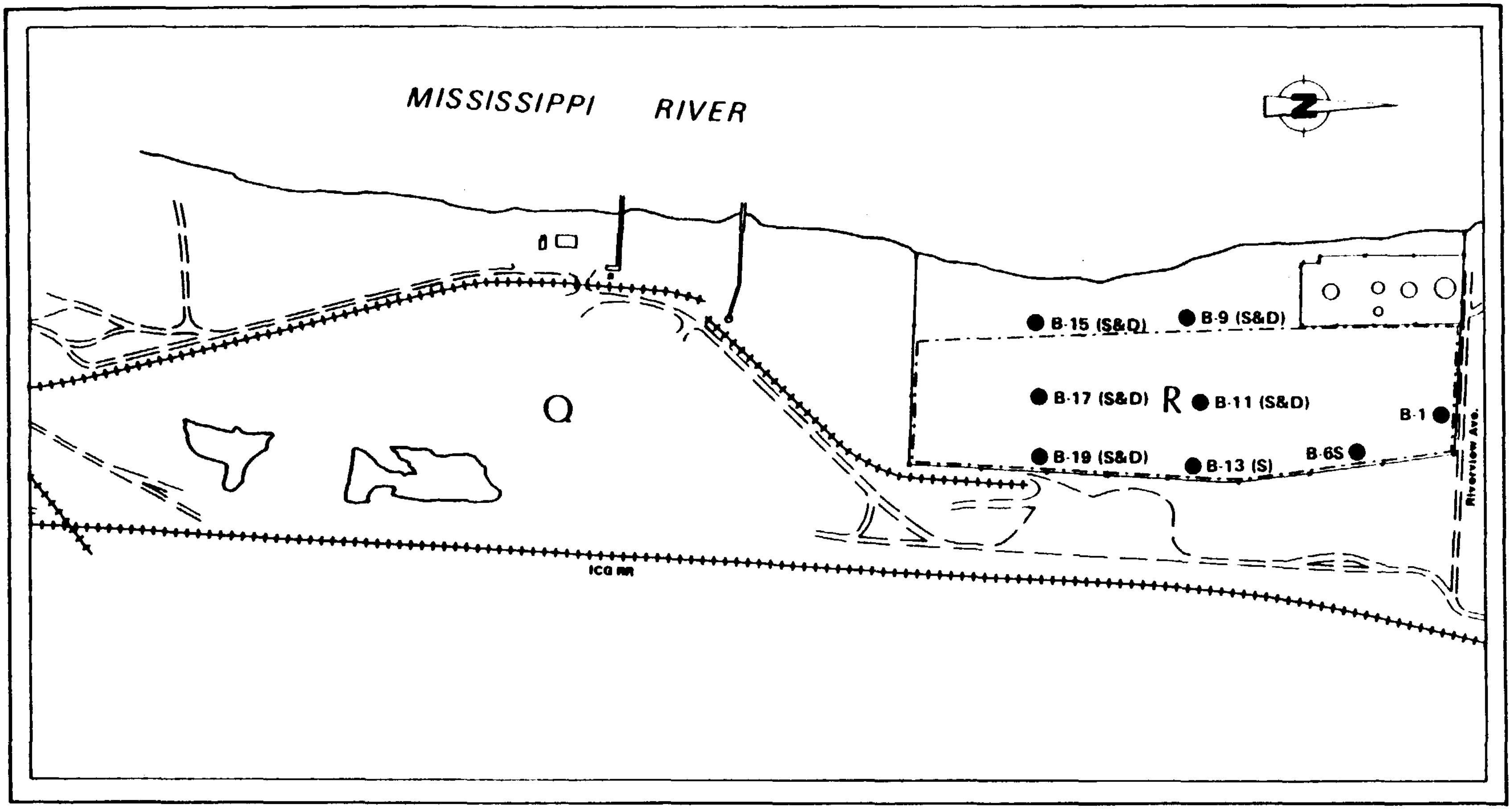


Figure 2–2 LOCATIONS OF MONITORING WELLS AT THE SAUGET TOXIC DUMP SAMPLED BY EPA

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Table 2-1

ANALYSIS OF GROUNDWATER SAMPLES FROM
SAUGET TOXIC DUMP
(COLLECTED BY IEPA ON OCTOBER 12, 1979)

	B-9S	B-9D	B-13D	B-15S	B-17S	B-19S
<u>Inorganics</u>						
Arsenic	.01	.004	.002	.002	.002	.007
Cadmium	.02		.01			.01
Chromium	.03		.04		.01	.03
Copper	1.2	.32	.87	.14	.42	1.6
Iron	290	100	130	56	110	230
Lead	0.2		0.3		0.1	0.2
Magnesium	31	10	27	83	11	28
Manganese	7.8	1	1.4	1.8	.99	2.8
Nickel	0.6	0.2	1.9	0.1	0.1	0.2
Zinc	3.3	.36	3	0.4	.52	.87
<u>Organics</u>						
Aliphatic hydrocarbons				*	*	*
Chlorophenol	*	*				.81
Chlorotoluene	70	40	10	.34	11	18
Dichlorobenzene						1.6
Diphenylether					.32	2.1
Phenol	21	56	10	14.3	41.5	22

<u>Notes:</u>

All results in ppm.
Blanks indicate below detection limits

*Contaminants present, but not quantified.

Table 2-2

ORGANIC ANALYSIS OF GROUNDWATER SAMPLES FROM
THE SAUGET TOXIC DUMP
(COLLECTED BY IEPA ON MARCH 25, 1981)

	B-1	B-6S	B-9S	B-9D	B-11S	B-11D	B-15D	B-17D	B-19D
Aliphatic hydrocarbons					4,000				
Biphenylamine	1,800	250			15,000	1,100	1,300	860	660
Chlorobenzene	3,000	130	720	810	1,000	2,800	2,800	650	300
Chlorophenol	6,600	5,300	11,000	12,000	13,000	3,200	3,200		950
Chloronitrobenzene			2,500	1,500					
Dichlorobenzene	2,600				1,000	800	930	420	360
Dichlorophenol	1,100	700				630	2,900	670	
Trichlorophenol								1,200	

Notes:

All results in ug/l (ppb).
Blanks indicate below detection limit.

Analyses of downstream samples S301 (Creek Sector C) and S302 (Creek Sector E) showed slightly elevated concentrations of copper and phosphorus when compared to the standards. A small amount of PCB (1.0 ppb) was detected in S301.

On the other hand, the samples taken from the Cerro Copper (Site I) holding ponds (sampling locations S503 and S504) show elevated concentrations of copper, iron, lead, mercury, nickel, phosphorus, silver, and zinc. PCBs (at concentrations of 22 and 28 ppb) and aliphatic hydrocarbons (23,000 ppb) were also detected in these samples.

Air Quality

This summary of the site air quality was compiled from the "Illinois Annual Air Quality Report, 1984" published by the IEPA in June 1985. The nearest monitoring location to the project area is at 13th and Tudor in East St. Louis, Illinois. Because the project area is located in a more industrialized area than the monitoring location, some of the recorded values may represent lower pollutant concentrations than those in actual project vicinity. The results of the 1984 monitoring are summarized in Table 2-3.

These data indicate that the air quality in the project area exceeds the National and Illinois Ambient Air Quality Standards for particulate matter; however, the particulate concentrations have consistently improved since 1979. The standard for ozone was violated twice during the year. The high concentrations occurred in June (1.31 ppm) and July (0.128) ppm). The highest concentration in August equalled the ozone standard (0.120 ppm). All other parameters for which ambient air quality standards exist were within acceptable levels.

No standards exist for sulfates, nitrates, and metals; however, the study area had the highest recorded ambient concentrations of cadmium and selenium in the state. The East St. Louis Metropolitan area, which also includes Granite City and Wood River, had the highest metals concentrations in the state.

2.3.2 Site-Specific Investigations

Several of the sites in the Dead Creek Project area have been studied in the past, or were part of a general study of possible

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Table 2-3

STUDY AREA AIR QUALITY SUMMARY

	Study Area Mean	Study Area Std. Dev.	Primary Standard	Secondary Standard
Particulate Matter (TSP) Annual Geometric Mean	77 ug/m^3	1.5	75 ug/m^3	60 ug/m^3
Sulfur Dioxide (SO_2) Annual Arithmetic Mean	0.020 ppm	3.31	0.03 ppm	--
Nitrogen Dioxide Annual Arithmetic Mean	0.023 ppm	1.64 ppm	0.053 ppm	0.053 ppm
Lead Annual Mean	0.44 ug/m^3	--	1.5 ug/m^3	1.5 ug/m^3

	Highest 1st	Highest 2nd	Highest 3rd	Primary Standard	Secondary Standard
Carbon Monoxide					
8-hour average	12.0 ppm	10.8 ppm	10.2 ppm	35 ppm	35 ppm
1-hour average	6.9 ppm	5.7 ppm	5.2 ppm	9 ppm	9 ppm

	Highest 1st	Highest 2nd	Primary Standard	Secondary Standard
Ozone	0.131 ppm	0.128 ppm	0.12 ppm	0.12 ppm

	Study Area Mean	Std. Dev.	Primary Standard	Secondary Standard
SO_4^{-2} Annual Arithmetic Mean	11.7 ppm	--	--	--
NO^- Annual Arithmetic Mean	3.9 ppm	--	--	--
As Annual Arithmetic Mean	0.008 ppm	--	--	--
Be Annual Arithmetic Mean	0.000 ppm	--	--	--
Cd Annual Arithmetic Mean	0.019 ppm	--	--	--
Fe Annual Arithmetic Mean	1.27 ppm	--	--	--
Mn Annual Arithmetic Mean	0.057 ppm	--	--	--
Ni Annual Arithmetic Mean	0.005 ppm	--	--	--
Se Annual Arithmetic Mean	0.004 ppm	--	--	--

contaminant sources in the Dead Creek area. These include sites G, H, I, L, M, O, Q, and R. No studies have been conducted to date at sites J, K, N, or P. The results of the sampling that has been conducted are summarized below.

Site G. Analysis of groundwater samples collected in 1980 and 1981 by the IEPA (St. John Report) revealed chlorinated phenols, as well as benzenes, PCBs, phosphorus, and lead. Surface soil samples revealed arsenic, lead, and PCBs. Subsurface soil sampling in Dead Creek showed PCBs to a depth of 6 feet. Soil samples were also collected on the dates listed above by the IEPA, and are included in the St. John Report.

Site H. Groundwater samples collected downgradient from this site in 1980 and 1981 by the IEPA were found to contain PCBs. No other sampling has occurred at this site.

Site I. Downgradient groundwater samples collected during the IEPA study in 1980 and 1981 revealed contaminants including chlorobenzene, dichlorobenzene, and metals. Surface sediment samples from the holding ponds (Creek Sector A) indicate PCBs, aliphatic hydrocarbons, dichlorobenzene, and arsenic. Surface water sampling at the holding ponds indicated the water contained nickel, arsenic, zinc, PCBs, and aliphatic hydrocarbons.

Site L. Downgradient groundwater sampling conducted by the IEPA in 1980 and 1981 indicated chlorophenol and cyclohexanone. Soil samples indicated the presence of PCBs and trichlorobenzene. A high level of total hydrocarbons was found in the soil.

Site M. The results of surface sediment sampling conducted by the IEPA in 1981 indicated the presence of PCBs, arsenic, and mercury. Surface water samples, taken at the same time, indicated low levels of PCBs and phosphorus.

Site O. Preliminary soil/waste sampling in areas to the northwest of the former lagoons conducted by IEPA in 1982 indicated PCBs and solvents were present at elevated levels. A number of surface soil samples taken in 1983 by the IEPA (and split samples by a private contractor for the Town of Sauget) contained dioxin.

Site P. The IEPA collected soil/waste samples at this site in 1979. However, no data are available at this time. IEPA site inspection reports indicate the presence of phosphorus pentasulfide, and miscellaneous containers of residual material.

Site Q. Subsurface soil sampling conducted by USEPA's FIT contractor in 1983 indicated the presence of 63 organic priority pollutants and dioxin. These samples were taken in 1983 in the northern portion of the site. Leachate samples collected in 1982 by the IEPA at the landfill boundary along the Mississippi River revealed several organic solvents.

Site R. In the early 1970s, the groundwater was sampled by the IEPA and analyzed for some indicator parameters. Subsequent groundwater sampling conducted by the IEPA in 1979 and 1981 indicated the presence of numerous organic contaminants in monitoring wells at the site. Leachate sediment samples have been taken on numerous occasions by the IEPA. The leachate and sediment samples taken in 1981 by USEPA's TAT contractor indicated the presence of solvents and dioxin.

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3. REMEDIAL INVESTIGATION

The RI involves two parts: preliminary tasks (1 through 6) involving the development of guidelines and background data for the project as a whole, and the primary RI tasks (7 through 11) involving the implementation of the field investigations, analysis of samples, identification of potential environmental risks, remedial technologies, and preparation of the RI report. The scope of work for each of these tasks is described below.

3.1 PRELIMINARY RI TASKS

3.1.1 Task 1: Initial Meeting

An initial meeting was held on September 25, 1985, between IEPA representatives and the E & E staff assigned to the Dead Creek Project. The meeting served to introduce the team members, discuss IEPA objectives, the scope of the study, and sensitive issues; and establish channels of communication.

3.1.2 Task 2: Work Plan

This plan defines the objectives of the RI/FS, and details the scope of work and schedule for accomplishing the RI/FS. The Work Plan is a flexible working document which serves to direct the work toward achieving the objectives of the study.

The Work Plan consists of: background information on the project and the project area; a definition of the objectives and scope of work; a Sampling Plan, which addresses all pertinent field activities; a Health and Safety Plan; a Quality Assurance Project Plan (QAPP), which will serve as a performance document to assure that all quality assurance objectives are met; a Community Relations Plan; and a Permitting Requirements Plan. This Work Plan was developed to achieve the objectives defined in the IEPA RFP and E & E's proposal.

3.1.2.1 Sampling Plan

The Sampling Plan, which is attached as Appendix B, will:

- Provide specific guidance for all fieldwork;
- Establish a mechanism for planning and approving site activities;
- Provide a basis for estimating costs of field efforts;
- Ensure that sampling activities are limited to those that are necessary and sufficient; and
- Provide a common point of reference for all parties to ensure comparability and compatibility between all activities performed at the site.

During the RI, it may be necessary to revise the Sampling Plan to increase the detail of information collected or to focus efforts on a particular problem. The Sampling Plan discusses the following items:

- Investigation objectives;
- Analyses of interest;
- Number of each sample type for each matrix;
- Sample locations;
- Justification for sample type and location;
- Collection methods;

- Sample number and frequencies;

- Analytical procedures, as referenced in the QAPP;

- Plan and schedule for sampling;

- Differentiation between samples that will be analyzed in the field (on-site) and those that will be sent to a laboratory; and;

- Sampling Logistics Plan, including:

  - Identification of team members,
  - Documentation procedures,
  - Field equipment listing,
  - Sampling order, and
  - Decontamination procedures.

3.1.2.2 Health and Safety Plan

The Health and Safety Plan is provided in Appendix C. The plan covers the work to be performed as part of the RI and is consistent with all applicable guidelines specified by the IEPA, including USEPA Orders 1440.1 and 1440.3; Section III(c)(6) of CERCLA; OSHA regulations; USEPA Occupational Health and Safety Manual; and USEPA Interim Standard Operating Safety Guide. The plan also reflects the currently available data concerning the project area.

Major elements of the Health and Safety Plan include:

- Site description, including availability of resources such as roads, water supply, electricity, and telephone service;

- Hazard evaluation (i.e., hazards to workers from on-site operations, assessment of off-site contamination hazards, potential routes of worker exposure to contamination);

- Monitoring requirements (e.g., ambient air monitoring);

- Levels of protection (i.e., protective clothing and respiratory protection requirements);

- Work limitations and safety training requirements;

- Authorized personnel;

- Decontamination procedures; and

- Emergency information.

3.1.2.3 <u>Quality Assurance Project Plan (QAPP)</u>.

The QAPP is provided in Appendix D. The QAPP is consistent with guidelines specified by IEPA and USEPA. The goals of the QAPP are:

- To ensure that all technical data generated is accurate, representative, and ultimately will withstand judicial scrutiny; and

- To ensure that all sampling and analytical activities are in compliance with the approved site-specific project plans.

The QAPP includes and addresses the following items and issues:

- Title page with provision for approval signatures;

- Project description;

- Project organization and responsibility;

- QA objectives for measurement data in terms of precision, accuracy, completeness, representativeness, and comparability;

- Sampling procedures;

- Sample custody procedures;

- Calibration procedure and frequency;
- Analytical procedures;
- Data reduction, validation, and reporting;
- Internal quality control checks;
- Performance and systems audits;
- Preventive maintenance procedures;
- Specific routine procedures to be used to assess data precision, accuracy, and completeness of specific measurement parameters involved;
- Corrective action; and
- Quality assurance reports.

3.1.2.4 Community Relations Plan

The Community Relations Plan (CRP) is provided in Appendix E. The CRP identifies the key issues of public concern relative to the Dead Creek area; emphasizes the importance of continued information flow to the public; and defines how comments from the affected community will be elicited during the project and how information about the project status will be disseminated to the community. The CRP also provides a list of key officials, media representatives, and property owners who will be kept abreast of project developments. In addition, the plan outlines a schedule for various community relations techniques, including the publication of project fact sheets, meetings, site visits, and formal public hearings.

3.1.2.5 Permitting Requirements Plan

The Permitting Requirements Plan, which is provided in Appendix F, identifies the procedures that will be employed should any of the tasks in the RI require permitting action by a governmental authority.

3.1.3 Task 3: Associated Support

Current site maps were prepared for the entire project area in accordance with the specifications of the Topographic Mapping and Geophysical Investigation Work Plan submitted to IEPA on October 7, 1985. The maps show elevations and locations of all pertinent physical features and facilities, as well as existing monitoring well locations. The maps are indexed in an overall area map in plate fashion.

A legal description of property boundaries was researched in the county records and verified in the field by conducting boundary surveys. The boundaries of parcels were indicated and indexed on the maps.

The topographic survey of the sites within the project area was performed by tying horizontal distances of appropriate physical features and facilities to property boundaries and vertical elevations to National Geodetic Datum (mean seal level). Topographic maps showing 2-foot contours and a scale of 1 inch = 100 feet have been produced. Accuracy of these maps is within 0.5 feet horizontal and 0.1 feet vertical.

3.1.4 Task 4: Additional Data Gathering: Existing Data Review and Evaluation

A search of files at federal and state agencies was conducted to identify and collect all available information concerning the site background, nature and extent of contamination, previous sampling and analyses, and previous response actions.

Specifically, the file search included review of information from the following sources:

- Illinois EPA files - central (Springfield) and regional (Collinsville) offices. Divisions of land, water, and air pollution;

- USEPA - Region V files - Divisions of Enforcement, Water Quality and Air;

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3.1.5 Task 5: Description or Current Situation

A summary of the current situation will be prepared which describes and assesses the current situation in the Dead Creek Project area on a site-by-site basis. The three main topics of this summary are:

- o Site background;
- o Nature and extent of the problem; and
- o History of response actions by local, state, federal or private agencies/parties.

This summary will be submitted to IEPA as part of Task 6, Interim/Preliminary Report, and will eventually constitute the introductory section of the overall RI Report (see Section 3.2.4, Task 10).

After the completion of Tasks 1 through 5, but prior to the initiation of any other task, a Preliminary Report will be submitted to IEPA for review and approval. This report will include a summary of the current situation in the Dead Creek Project area (developed in Task 5), as well as all information collected during Task 4 and for the preparation of the RI/FS Work Plan. The report also will assess the usefulness of the data collected in Task 4, and will discuss the appropriate remedial actions that may be considered, given the nature of the existing site conditions. The possible effects of the considered alternatives and any proposed changes in the scope of work or the RI/FS Work Plan will be described.

3.1.6 Task 6: Interim/Preliminary Report

- o US Army Corps of Engineers - St. Louis District Office. Published reports and open-file information;
- o Illinois State Geological Survey - published reports and open-file information;

- o Illinois State Water Survey - published reports and open-file information; and

- o Illinois attorney general's office - Springfield. General file information.

Validation analyses will be performed on all existing data to identify any data deficiencies and to insure that any sampling necessary to fill the gaps is scheduled as part of the RI. These data and supporting documentation will be evaluated using procedures similar to a quality assurance audit.

3.2 PRIMARY RI TASKS

3.2.1 Task 7: Site Investigations

The objective of the RI fieldwork is to investigate the extent and magnitude of contamination in surface soils, subsurface soils, groundwater, surface water, sediment, and air at each of the sites in the Dead Creek Project area. Sampling activities will be centered around the compilation of data needed to: characterize the contamination in the project area; determine potential risks to public health and the environment; and identify appropriate remedial alternatives for each site. The specific goals of the sampling in each environmental media are described below.

3.2.1.1 Investigation Goals/General Task Descriptions

The goal of the site investigations is to provide the following basic information:

- o A description of the groundwater movement in the area;

- o An assessment of the effects of area groundwater pumping on groundwater movement;

- o An assessment of whether the industrial use of groundwater poses a hazard to area residents or to the environment;

- o An evaluation of the interrelationships/balance for contamination sources and the environmental media in which they exist;
- o An assessment of the current effects of area industries on the local environment;
- o An assessment of the extent to which air emissions influence public health as a result of permitted and unpermitted contaminant releases;
- o An assessment of the effects of modifying surface drainage patterns in the area;
- o An assessment of the validity of the concept of "plume management" for the area;
- o An assessment of the extent to which groundwater use, land use development, and construction activities that can be legally limited in the project area;
- o A determination of acceptable contaminant levels for the area; and
- o An assessment of the effects existing industries have on the level of risk for the population in the project area.

The specific goals of the investigations for each different environmental media (e.g., surface soil, subsurface soil, surface water, groundwater) are described below.

Surface Soil. Several of the sites are known to have hazardous materials exposed at or occurring near the surface. The goals for surface soil investigation are to:

- o Define overall extent of surface contamination;
- o Describe and categorize contaminant types;

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- Locate and define "hot spot" areas of contamination;
- Determine general depths of contaminants near surface and rates of leaching; and
- Estimate the quantities of contaminated soil, which will require remedial action.

Subsurface Soil. The goals of the subsurface soil investigations are to:

- Investigate and locate subsurface areas containing hazardous materials including areas which may have received bulk solid or liquid wastes in addition to containerized wastes;
- Identify and categorize waste materials which are detected; and
- Estimate quantities of waste requiring remedial activities.

Surface Water. The goals of the surface water investigations are to:

- Define surface water drainage patterns at each site;
- Determine rates of runoff and infiltration in the area;
- Determine types of contaminants in water and possible sources, including:
    - Surface runoff,
    - Solubilization of substrate contaminants, and
    - Groundwater; and
- Estimate quantity of water which requires remedial activity.

Groundwater. The goals of hydrogeologic investigations are to describe the movement of groundwater in terms of velocity and direction and to identify the limits of existing groundwater contamination. The conceptual approach is, first, to define groundwater movement and then to identify contaminants on spatial basis and predict future contaminant movement.

Air. The goals of the air investigations are to:

- Characterize the nature and areal extent of air contaminants associated with each site; and
- Identify point sources for air contaminants detected, including those which are diffusing from the soil to the air compartment.

3.2.1.2 Field Investigation

The field investigation to be conducted to achieve the above objectives will consist of surface soil, subsurface soil, surface water/sediment, hydrogeologic, and air quality investigations. The locations and number of sampling and monitoring well installations were defined by the IEPA.

Surface Soil Investigation. The investigation of surface soil will consist of collection and analysis of 85 surface soil samples plus the required quality control (QC) samples taken from five site areas: G, H, I, J, and N. Details of the sampling locations and procedures are presented in the Sampling Plan. Analyses for all Hazardous Substance List (HSL) compounds, metals, and cyanide will be conducted. Stainless steel scoops will be used to collect surface soil samples. Samples will be collected on both a random and a grid basis, as prescribed by IEPA. Samples will be field screened using an organic vapor analyzer (OVA) to select samples for laboratory analysis. Decontamination of sampling equipment will assure that no cross contamination occurs.

Subsurface Soil Investigation. The subsurface soil investigation will consist of geophysical testing and subsurface soil sampling. The geophysical investigation will consist of a study using a flux gate gradiometer magnetometer in combination with electromagnetic (EM) conductivity to try to define the lateral boundaries of buried wastes. The results of the study will be used to try to define estimated waste depths. The location of and procedures for the geophysical study were defined in the report Topographic Mapping and Geophysical Investigation Work Plan, submitted to IEPA on October 7, 1985.

A total of 44 subsurface soil samples plus the required number of QC samples will be taken from borings at seven sites: G, H, I, J, K, L, and N. The locations of the borings and the subsurface samples will be based on the results of the geophysical investigation, examination of historical aerial photographs, and on visual inspections. Boring depths will range from 20 to 50 feet. Samples from the borings will be composited to achieve the greatest cross sectional examination of subsurface materials within the limits of the sample number allocated to the project by IEPA. Details concerning sample locations and procedures are included in the sampling plan. Samples will be analyzed for all HSL compounds, metals, and cyanide.

Surface Water and Sediment Investigation. The surface water and sediment investigation will consist of collection and analysis of samples and infiltration testing. A total of 17 surface water and 33 sediment samples will be collected along with the required number of QC samples from Dead Creek (sectors A, B, C, D, E, and F) and from Site M, adjacent to the creek. Samples will be collected upstream and downstream in each of the creek and will consist of individual grab samples and composites to achieve the broadest assessment of the contamination present. The locations and procedures for surface water/ sediment sampling are included in the Sampling Plan. The samples will be analyzed for all HSL compounds, metals, and cyanide.

A field investigation of surface water infiltration rates also will be conducted. Runoff and infiltration rates will be approximated by conducting double ring infiltrometer tests in the project area. As many as 20 tests will be conducted, at locations to be selected based on field observations.

Hydrogeologic Investigation. The hydrogeologic investigation will consist of installation of monitoring wells, physical testing and chemical testing of the groundwater, and soil gas monitoring. Twenty groundwater monitoring wells will be installed around three sites: Q, and R. The proposed locations of these wells is presented in the Sampling Plan. The wells will be installed using a hollow-stem auger. Casings will be advanced while drilling to prevent downhole cross contamination. Monitoring well construction will consist of nominal, two-inch inside diameter, stainless steel risers and screens. The well screens will be 5 feet in length and will contain 0.01-inch slots. The wells will extend approximately 2 feet above surface grade, and will have a 5-foot protective steel casing with a locking cap placed over them. This will entail cementing three 3 of this protective casing in the ground to provide a secure base. All wells then will be surveyed to USGS Geodetic Datum. All other aspects of monitoring well installation will conform to guidelines set forth by IEPA (see Figure 3-1). Wells will be developed using air surging. Following development and stabilization of the monitoring wells, water levels will be recorded and slug tests will be performed to determine hydraulic conductivity. These tests will be performed using accepted hydraulic conductivity methodology. Temperature and pH readings also will be obtained

Groundwater sampling will consist of a single round of sampling of the 20 new monitoring wells, 12 existing IEPA wells, and five residential wells. The sampling of existing IEPA wells will be dependent upon a determination by IEPA and E & E of the acceptability of the integrity of the IEPA wells. Prior to groundwater sampling, a minimum of three well volumes will be purged from each well. Samples will be collected using dedicated stainless steel bailers in order to reduce the risk of cross contamination between wells. Field-filtering of all inorganic parameters (except cyanide and mercury) will be provided using a 0.45-micron filter. Samples will be analyzed for all HSL compounds, metals and cyanide.

A soil gas monitoring investigation will be conducted to define the presence of volatile organics in the vadose zone and thus identify the extent of organic contaminant plumes. The soil gas monitoring will be conducted after surface soil and subsurface soil

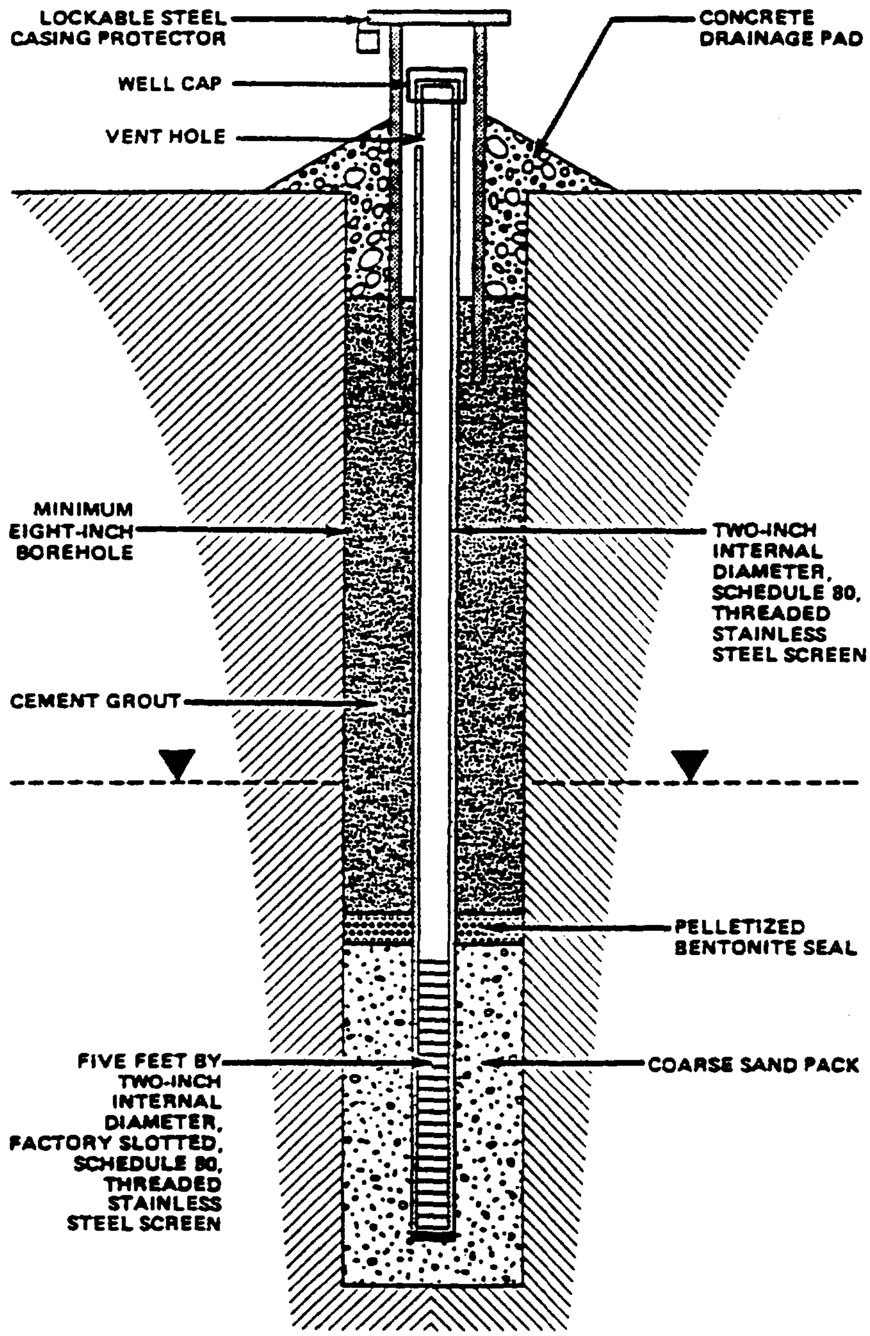

Figure 3–1 GENERALIZED WELL CONSTRUCTION

tions are complete. Soil gas monitoring will be conducted at sites H, L, G, M, N, K, J, I, and sectors A through E of Dead Creek. A total of 96 well points will be sampled. Using a mini-well-point-sampler, the first 10 feet of subsurface soil will be sampled and evaluated for the presence of volatile organics. The samples will be analyzed using an OVA to determine the amount of volatile organics present. The locations and procedures for the soil gas monitoring investigation are included in the Sampling Plan.

Air Investigation. An air investigation will be conducted to define air contaminants associated with the study sites. Initially, local meteorological information will be defined using a portable station. At the same time, field screening of sites using OVAs and Photovac portable gas chromatographs will be used to define "hot spots" of organic emissions. Visual observations will be made to determine site sources of particulate emissions. Based upon these findings, upgradient and downgradient site monitoring stations will be established. High-volume particulate samplers (hi-vols) and portable GCs or Tenax tube collectors will be used to characterize contaminants and emission volumes. In addition, where possible, soil gas monitoring data will be used to help define emissions from the sites.

3.2.2 Task 8: Preliminary Remedial Technologies

This task will be performed in two stages, the Pre-Investigation Evaluation and the Post-Investigation Evaluation.

Pre-Investigation Evaluation. Prior to the initiation of the site investigation, potential remedial measures will be assessed for both source control and off-site action. The following questions will be considered during this evaluation:

- o What contaminant techniques appear feasible to prevent or contain contamination of various matrices?
- o Does on-site treatment appear to be a viable option, and if so, what category of treatment should be investigated (e.g., biological, physical, chemical, thermal)?

The results and data from all site investigations will be organized and presented logically so that the relationships between the investigations of each environmental matrix are described.

Data Analysis. All site investigation data will be analyzed and a summary of the type and extent of contamination at the sites will be developed. The summary will describe the extent of contamination (qualitative/quantitative) in relation to background levels indicative for the area.

Exposure (Risk) Assessment. From the detailed listing of contaminants found at the facility, a representative group will be evaluated for risk to life forms encountering these contaminants. The following items will be discussed for each contaminant in the representative group:

- Environmental Fate and Transport
  - Physical and chemical properties,
  - Chemical transformations, and
  - Fate and transport.
- Toxicological Properties
  - Metabolism,
  - Acute toxicity,
  - Subacute and chronic toxicity,
  - Carcinogenicity,
  - Mutagenicity,
  - Teratogenicity/reproductive effects,
  - Other health effects,
  - Epidemiological evidence, and
  - Aquatic species toxicity, environmental improvement.
- Risk Assessment and Impact Evaluation
  - Carcinogenic risk,

- Probability of noncarcinogenic human health effects,
- Nonhuman species risk assessment, and
- Conclusions

o <u>Demographic Profile of Population of Risk</u>

  - The analysis will discuss the degree to which either source control or off-site measures are required to significantly mitigate the threat to public health, welfare, or the environment. If the results of the investigation indicate that no threat or potential threat exists, a recommendation to stop the remedial response will be made.

<u>Application to Preliminary Technologies</u>. The results of the site investigations will be analyzed in relation to the preliminary remedial technologies and compatibility of wastes and construction materials, and other conclusions will be presented.

3.2.4 Task 10: Remedial Investigation Report

A draft RI report will be prepared and submitted to IEPA for review and public comment. The report will summarize all site investigations, present results from these investigations, and present findings and conclusions concerning the study area. A final report will be prepared and will incorporate all comments received on the draft report.

3.2.5 Task 11: Additional Requirements

The following items do not correctly fall within the scope of any of the above-described tasks, but are required for the project.

<u>Community Relations Support</u>. The personnel, services, materials and equipment required to undertake a community relations program will be provided. Community relations will be integrated closely with all remedial response activities.

The objectives of this effort are to achieve community understanding of the actions taken and to obtain community input and

4. FEASIBILITY STUDY

4.1 FEASIBILITY STUDY TASKS

4.1.1 Task 12: Description of Current Situation and Proposed Response

The summary prepared in Task 5 will be updated as necessary for this task. Following this summary, a site-specific statement of the purpose of the response, based on the results of the RI, will be presented. The statement of purpose will describe the evaluation of alternatives for each medium affected (groundwater, surface water, air, and soil/sediments).

4.1.2 Task 13: Development of Alternatives

Based on the results of the RI and the evaluations in Task 8, remedial response objectives and alternatives for source control, off-site remedial actions, or both will be developed. In accordance with the procedures presented in Subpart F of the National Contingency Plan (NCP) and established federal and state health-protective (health advisories) and environmental quality criteria, the substances, environmental media, and receptors present at or affected by the sites in the Dead Creek Project area will be identified. The substances considered will include not only the priority pollutants, but also the most prevalent nonpriority pollutant compounds detected at the sites. For substances of concern for which health-protective or clean-up criteria have not been established, other appropriate references will be used to assess toxicity and to recommend appropriate exposure limits for use as response criteria. These other sources will include:

- Occupational Safety and Health Administration (OSHA)
  - Regulations for airborne chemicals

- U.S. Environmental Protection Agency (USEPA)
  - Guidelines for exposure to airborne organic chemicals
  - National Interim Primary Drinking Water Standards (NIPDW)
  - Suggested No Adverse Response Limits (SNARLS)
  - Cancer Risk Assessments

- Illinois EPA-Discharge and Stream Quality Limitations
  - Water Quality Criteria
  - National Pollutant Discharge Elimination System (NPDES)
  - Multimedia Environmental Goals (MEGs)

- National Academy of Science (NAS)

- World Health Organization (WHO)

- Other technical literature

Preliminary recommendations for response objectives and evaluation criteria will be submitted for review and approval by IEPA.

In addition to the technologies evaluated in Task 8, complete removal and no-action alternatives will be discussed. Because of the complexity of the on-site conditions and the hydrogeologic characteristics of the Dead Creek area, it is anticipated that several combinations of remedial technologies will be included in the selected remedial alternatives. These alternatives will be selected on the basis of their capability to protect public health and the environment. The alternatives will be developed in consultation with IEPA.

4.1.3 Task 14: Initial Screening of Alternatives

The alternatives developed in Task 8 will be screened to eliminate alternatives that are clearly infeasible or inappropriate, prior to undertaking detailed evaluations of the remaining alternatives. The following considerations must be used as a basis for the initial screening:

6. PROJECT MANAGEMENT/ORGANIZATION

6.1 ORGANIZATION AND STAFFING

The project organization for the RI/FS is shown on Figure 6-1. The project manager, Mr. M. Miller, will be responsible for the overall management of the entire work effort. He will be supported by two assistant managers--one for the RI phase and one for the FS phase. The RI assistant project manager, Mr. M. McCarrin, will direct the RI tasks and serve as team leader for field investigations. He will be supported by the E & E Analytical Services Center (ASC), E & E subcontractor services, and E & E technical staff. Mr. R. Marszalkowski, the FS assistant project manager, will perform in a similar capacity during the FS phase.

Two E & E staff members will be assigned full-time to the RI. Additional staff will be assigned as required to complete specific project tasks. It is anticipated that during the field investigation phase of the RI, three to five persons will be involved in field sampling activities.

The FS will be conducted primarily by senior-level engineers who have experience in conducting similar remedial evaluations. The assistant project manager and project manager will be assigned full-time; other personnel will be dedicated to the project during the FS phase on an as-needed basis.

6.2 MANAGEMENT REPORTING REQUIREMENTS

Monthly reports will be prepared that describe the technical and financial progress of the project. These reports will discuss the following items:

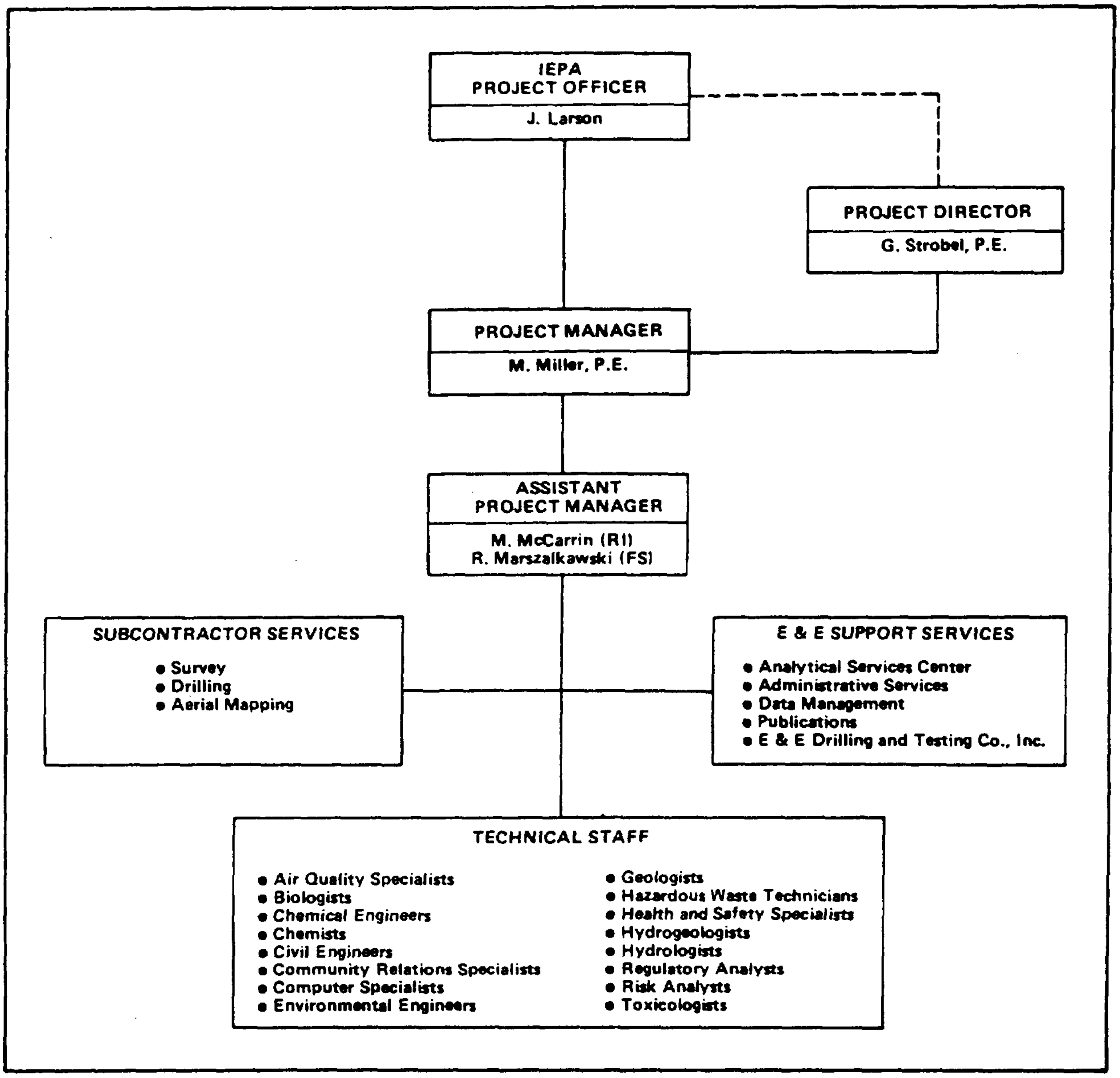

Figure 6–1 PROJECT ORGANIZATION

- Identification of site and activity;
- Status of work at the site and progress to date;
- Percentage of completion in terms of both expenditures and scope;
- Difficulties encountered during the reporting period;
- Actions being taken to rectify problems;
- Activities planned for the next month;
- Changes in personnel;
- Actual expenditures including fee and direct labor hours expended for the reporting;
- Cumulative expenditures (including fee) and cumulative direct labor hours;
- Projection of expenditures for completing the project, including an explanation of any significant variation from the forcasted target;
- A graphic representation of proposed versus actual expenditures (plus fee) and comparison of actual versus target direct labor hours; and
- Any analytical data not submitted previously for the month.

The monthly progress reports will list target and actual completion dates for each activity element, including project completion, and will provide an explanation of any deviation from the milestones in the Work Plan schedule (see Section 5).

7. BUDGET

The budget for the project was established based on E & E's proposal of May 20, 1985. The RI budget is summarized in Table 7-1, while the FS budget is presented in Table 7-2. A detailed cost breakout is included in the IEPA Professional Services Contract Agreement dated September 9, 1985.

Table 7-1

REMEDIAL INVESTIGATION BUDGET

	Initial Meeting ($)	Data Gathering ($)	Associated Support ($)	Work Plan ($)	Preliminary Report ($)	Site Investigation ($)	RI Report ($)	Additional Requirements ($)	Total ($)
Labor, Fringe, Overhead	1,874	4,834	3,275	8,649	5,086	95,432	28,851	3,812	151,813
Travel	1,326	4,284	2,664	1,108	0	78,780	0	582	88,744
Subcontracts	0	0	14,000	0	0	75,000	0	0	89,000
ODC	0	420	1,120	420	270	49,340	700	248	52,518
SGA	896	2,670	1,976	2,850	1,499	62,595	8,274	1,300	82,060
Fees	397	1,105	1,487	1,537	863	26,595	4,845	688	37,361
Laboratory Costs	0	0	0	0	0	345,190	0	0	345,190
Equipment Usage	0	0	0	0	0	9,936	0	0	9,936
Totals	4,493	13,313	24,522	14,564	7,718	742,712	42,670	6,630	856,622

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Table 7-2

FEASIBILITY STUDY BUDGET

	Report of Preliminary Alternatives	F.S. Report	Additional Requirements	Total
Labor, Fringe, Overhead	84,643	9,530	5,718	99,901
Travel	2,700	0	872	3,572
Subcontracts	0	0	0	0
ODC	3,900	300	372	4,572
SG & A	25,550	2,752	1,950	30,252
Fees	14,508	1,606	1,031	17,145
Laboratory Costs	0	0	0	0
Equipment Usage	0	0	0	0
Total	131,301	14,188	9,943	155,442
			TOTAL	310,874

APPENDIX A

STATE OF ILLINOIS

ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

A PRELIMINARY HYDROGEOLOGIC INVESTIGATION IN THE NORTHERN PORTION OF DEAD CREEK AND VICINITY

By

Ron St. John

April, 1981

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES

- Cost and cost-effectiveness,
- Environmental effects,
- Environmental protection,
- Compliance with state and federal requirements, and
- Implementability and reliability.

The results of the screening evaluation will be submitted to IEPA for review. Each of the screening criteria is discussed briefly below.

Cost and Cost-Effectiveness

The first step will be to define a cost for implementation and operation of each remedial alternative to within an accuracy goal of +100% to -50%. Using these data and guidance from IEPA, inordinately high-cost remedial alternatives (order of magnitude differences) will be eliminated from consideration. Generalized unit costs will be calculated for the remedial alternatives using data from USEPA technical manuals, specific information from construction firms, and standard engineering cost price logs.

Evaluation of Environmental Effects

Many remedial action alternatives could be feasible for the site from an engineering and cost standpoint. However, as a requirement of the NCP, the remedial action also must be environmentally sound and not result in additional adverse impacts to the environment. Environmental effects will be evaluated in terms of impacts to air, surface and groundwater, soil characteristics, vegetation, and public health and safety.

Each remedial action will be evaluated for its environmental impact on the basis of effectiveness testing, engineering evaluation, or predictive modeling and environmental monitoring. The result of these tests will be used in making a determination of environmental effects. The criteria used to establish environmental effects are:

- Media being impacted;

- Ecological systems being affected;

- Identification of sensitive organisms (species abundance, extinction, energy conservation, appearance of species and food chain);

- Toxicity;

- Volatility estimations;

- Bioaccumulation potential; and

- Environmental fate of constituents.

Environmental Protection

The alternatives selected must satisfy the response objective developed in Task 13. Also, the alternatives must substantially contribute to the protection of public health and welfare or to the environment. If source controls do not adequately control source materials or if off-site alternatives do not minimize or mitigate the threat to the public or environment, the alternative will be rejected.

Compliance with State and Federal Requirements

Each alternative will be reviewed to determine if portions would violate existing local, state, and federal laws or regulations. Also, the review would determine if these laws or regulations would cause an undue increase in the cost of the alternative.

Local zoning and construction permit requirements will be reviewed to determine if these constraints affect the implementation of an alternative. Also, siting problems and easement acquisition requirements will be reviewed.

Implementability (Acceptable Engineering Practices)

In conducting the screening, the feasibility of implementing the technology involved in each alternative will be considered. Because of the critical nature of a hazardous waste cleanup, it may be imprudent to use unproven or experimental technology. The feasibility of each option will be evaluated, considering such factors as applicability of identified contaminants, proven reliability of the technology, expected duration of the action, applicability to site operational requirements, hazards of implementation, and site restrictions.

4.1.4 Task 15: Laboratory Studies

Laboratory and bench-scale treatability studies will be conducted as necessary to evaluate treatment effectiveness and establish design criteria. Such testing yields information on the permeability or compatibility of various proposed materials with the wastes, or the effectiveness of different methods of treating the waste. The studies necessary will depend on the results of Tasks 13 and 14. The scope of this task cannot be accurately assessed until the alternatives are developed and initial screening completed. A separate laboratory studies work plan will be submitted to IEPA for approval.

4.1.5 Task 16: Evaluation of the Alternatives

The alternatives developed in Task 14 will be evaluated and recommendations made to IEPA. The following procedures will be used in this evaluation:

Detailed Alternative Development

Prior to evaluation, a discussion of all aspects of an alternative which may affect the outcome is necessary. The following information will be discussed in this task:

- Each containment, treatment, and disposal technology;

- Special engineering considerations necessary to implement each alternative;

- Environmental impacts and proposed methods and costs for mitigating any adverse effects;

- Any operation, maintenance, and monitoring requirements of each remedy;

- Off-site disposal needs and transportation plans;
- Any temporary storage requirements;
- Health and safety requirements, and considerations for implementation of each alternative;
- Methods by which each alternative could be implemented as various operable units to result in a total remedy, representing a significant improvement to the environment and/or savings in costs;
- Ways in which the alternative could be segmented to allow implementation of the alternative;
- A review of off-site facilities, applicable to an alternative, to assure compliance with current and proposed RCRA requirements; and
- Action levels of the progressive extent of the remedy, if applicable to the alternative

Environmental Assessment

Each of the screened alternatives will undergo an Environmental Assessment (EA), to include:

- An evaluation of each alternative's environmental effects;
- An analysis of measures to mitigate adverse effects;
- Descriptions of any physical and legal constraints;
- Compliance with CERCLA and other regulatory requirements;
- Assessment of the extent to which the alternative mitigates long-term exposure and protects public health during and after the remedial action;

- A risk assessment;

- An evaluation of time versus level of exposure to contaminants; and

- A comparison of the selected alternative against the no-action alternative as effecting a relative reduction in adverse public health.

A major element of the EA is the public health evaluation; specifically, the approach taken to evaluate the extent to which each of the various remedial actions reduces risk to public health risk reductions of the various remedial actions. The following is discussion of the approach to the assessment.

The candidate remedial actions and the associated level of cleanup attainable for each alternative will be specified. Then, transport or compartmental models may be applied to predict on-site and off-site reductions in contaminant concentrations for air, surface water and groundwater, soil, sediment, and biota (especially fish). Since contaminants vary drastically in their physical-chemical properties and transport behavior, representative contaminants will be targeted according to their toxicity, concentration, and environmental fate and transport behavior.

The reduced concentrations for the various compartments will be translated into exposures for the targeted contaminants. In some instances, short-term exposures actually may be increased. Analytical data from the RI will be used to characterize exposure from the no-action alternative.

For all alternatives or packages of alternatives, the exposure assessment will contain subcalculations of exposure by all of the relevant pathway-receptor combinations. Pathways for these receptors could include air (inhalation during construction), groundwater (ingestion by downgradient users and dermal contact by workers), and ingestion of fish. Each pathway-receptor combination will be evaluated in order to avoid overlooking the less obvious exposures.

- Comparison Ranking. Summary exposures from each alternative will be listed in tabular form for the targeted contaminants and for each alternative. More detailed exposure breakdowns by pathway and receptor will be appended. Where possible, short-term and long-term exposures will be presented, since a short-term exposure increase may be justified by a longer term decrease. The tables will present the remedial alternatives from lowest to greatest increase in health protection (exposure reduction), and will contain the no-action alternative according to its rank.

- Off-Site Exposures. All remedial alternatives are likely to cause small but negligible on-site exposures to site workers. In some cases, on-site exposures may occur to members of the public when site access is not adequately restricted or the site boundary is not well defined. Off-site exposures may be required to meet the additional test of compliance with existing USEPA standards or other federal or state health standards and criteria. Air, food chain, and especially surface water and groundwater used for drinking have federally specified health criteria regarding certain contaminants. For this test, exposure is not the conventional measure; instead, contaminant concentrations are specified by law or regulation. Additional tables will be provided showing projected off-site concentrations for the targeted substances in air, surface water and groundwater, soil, and (where applicable) food chain items such as fish. The tables will contain a similar matrix ranking of remedial action and off-site compartmental concentrations. Applicable criteria and standards will be provided for comparison. When criteria or standards are not available, the relative effectiveness in reducing concentrations will be a selection criteria.

Cost Analysis

A detailed cost evaluation will be conducted for each remedial action alternative that is to be considered. The estimated cost of each alternative will include direct construction and operating costs (operation, maintenance, and monitoring), as well as indirect costs. The long-term operating costs of a remedial plan typically are not considered to be an eligible cost of CERCLA-supported site cleanup operations. Consequently, capital and operating costs will be considered independently in developing strategies. These costs will be expressed as the total capital cost of implementation and the present worth of the operating costs over a maximum of 30 years. The evaluation of cost will include an analysis of the sensitivity of cost to the degree of level of implementation.

Evaluation and Recommendation of Alternatives

The alternatives each will be evaluated using a set of technical, environmental, and economic criteria. These criteria are as follows:

- Reliability. Alternatives that minimize or eliminate the potential for release of contaminants into the environment will be considered more reliable than other alternatives. Institutional concerns such as management requirements also may be considered as reliability factors.

- Implementability. The requirements of implementing the alternatives will be considered, including phasing alternatives into operable units and segmenting alternatives into project areas on the site. The requirements for permits, zoning restrictions, rights-of-way, and public acceptability also will be considered.

- Operating and maintenance (O&M) requirements. Preference will be given to projects with lower O&M requirements, other factors being equal.

- Environmental effects. Alternatives posing the least adverse impact (or greatest improvement) on the environment will identified.

- Safety requirements. On-site and off-site safety requirements during implementation of the alternatives will be considered.

Alternatives with lower safety impact and cost will be identified.

- Cost. The remedial alternative with the lowest total cost will be favored. Total cost will include capital cost for implementing the alternative as well as cost of O&M for the proposed alternative.

A summary of the evaluation criteria and results for each alternative will be tabulated in order to facilitate comparison of the alternatives. Also, recommendations on the most cost-effective alternative will be prepared. This summary and the recommendations will be submitted to IEPA as part of the Draft FS Report.

4.1.6 Task 17: Preliminary Report

A preliminary report presenting the results of Tasks 12 through 16 and recommending a remedial alternative will be prepared and forwarded to IEPA. The report will contain the description of the current situation and proposed response, the results of laboratory studies, the results of the evaluation of alternatives, health risk assessments, cost analysis, and cost-effectiveness analysis.

In addition to the above items, the report will contain a detailed description of all alternatives, to include:

- A description of the appropriate treatment and disposal technology for each evaluated alternative;

- A description of any special engineering considerations required to implement each evaluated alternative, e.g., any additional studies that may be needed (pilot plant, treatability, etc.) to proceed with final remedial action design;

- A description of operation, maintenance, and monitoring requirements for each evaluated alternative;

- A description of any off-site disposal needs and transportation plans for each evaluated alternative;

- A description of any temporary storage requirements for each evaluated alternative;

- A description of safety requirements associated with implementing each evaluated alternative, including both on-site and off-site health and safety considerations;

- A description of how any of the other remaining evaluated alternatives could be combined with each evaluated alternative and how any of the combinations could best be implemented to produce significant environmental improvements or cost savings; and

- A description/review of any on-site or off-site treatment or disposal facilities which could be utilized in association with each alternative to ensure compliance with applicable requirements of the Resource Conservation and Recovery Act, IEPA hazardous waste rules, and the U.S. and Illinois Departments of Transportation rules.

A general report format is presented below:

- Executive summary
- Introduction
  - background
  - purpose
  - scope

- Review of RI report

- Preliminary list of remedial action alternatives
  - physical evaluation
  - chemical evaluation

- Initial screening of alternatives
  - feasibility
  - environmental acceptability

  - protection provided
  - life
  - cost

- Detailed analysis
  - established technology
  - environmental impacts and feasibility
  - cost
  - regulatory acceptability
  - engineering implementation, constructability, and operability
  - impact of degree of cleanliness or protection provided on cost
  - time required to implement
  - requirement for treatability, extra date, or other studies prior to design
  - short-term, long-term effects
  - effects of phasing
  - requirement for contingencies

- Conclusions and recommendations

4.1.7 Task 18: Conceptual Design

A conceptual design of the remedial alternative selected by IEPA will be prepared. The conceptual design will include:

- Engineering approach with implementation schedule;

- Special implementation requirements;

- Institutional requirements;

- Phasing and segmenting considerations;

- Preliminary design criteria, preliminary site and facility layouts;

- Budget cost estimate (including operation and maintenance costs);

- Operating and maintenance requirements and duration; and

- An outline of the safety plan with the cost impact of implementation.

Any additional information required as the basis for the completion of the final remedial design will also be included.

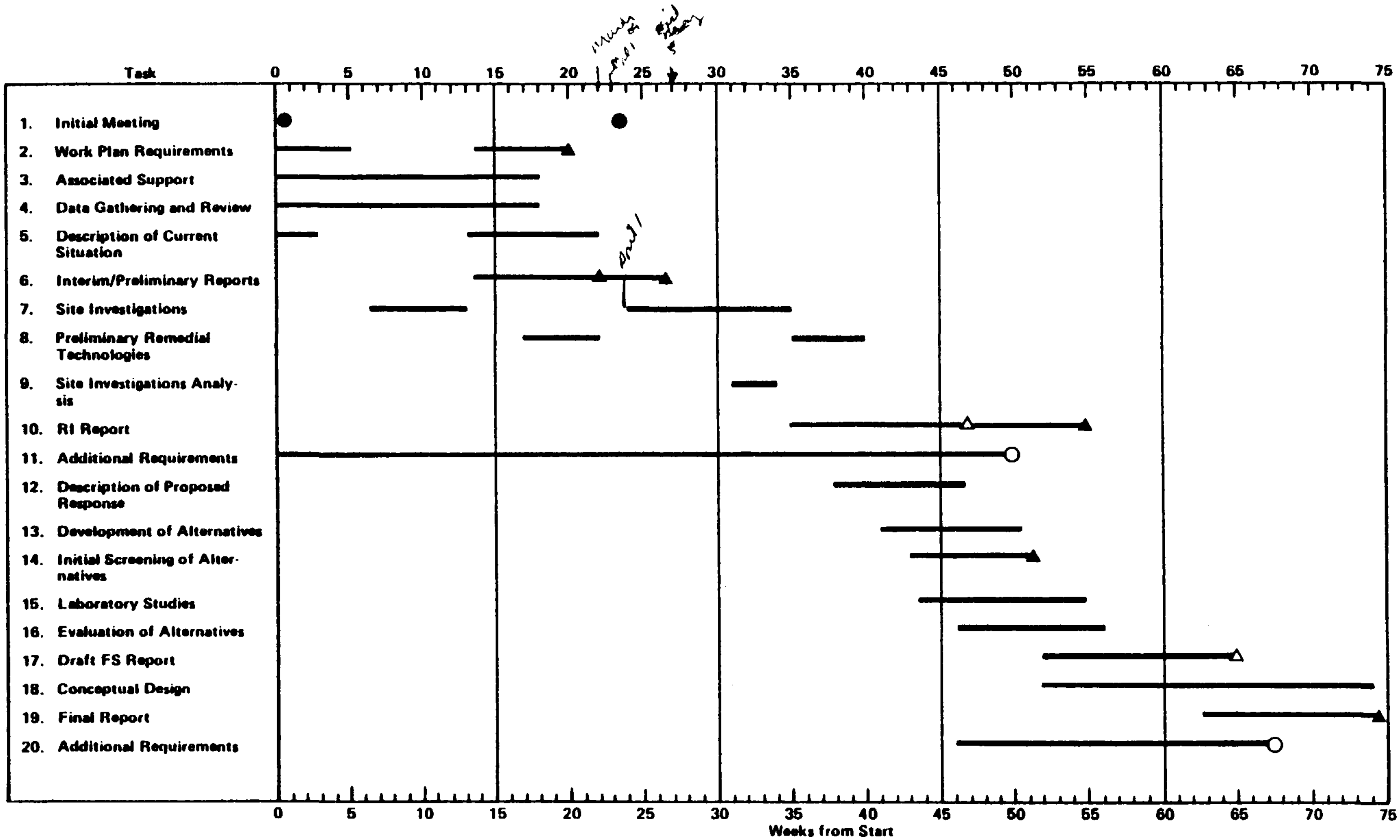
4.1.8 Task 19: Final Report

A final report will be prepared and submitted to IEPA. This report will include the results of Tasks 12 through 18.

4.1.9 Task 20: Additional Requirements

Reporting and community relations support, as described in Section 6 in Section 3.2.5 (Task 11 of the RI portion of the work), also will be continued for the FS.

5. PROJECT SCHEDULE



Key: △ Draft Report ▲ Final Report ● Meeting ○ Public Hearing

Figure 5—1 PROJECT SCHEDULE: PROPOSED RI/FS ACTIVITIES

Draft

Introduction

Problem

The Illinois Environmental Protection Agency (IEPA) was made aware of a site in Cahokia, Illinois in May, 1980. There was a problem with periodic smoldering of materials in a ditch (Dead Creek) due to random dumping. Immediately, the problem did not appear to be serious, but when a local resident's dog rolled in the ditch and died of apparent chemical burns in August, 1980, it was clear that further investigation was need. IEPA personnel then did preliminary soil and water sampling to determine the conditions in the ditch. Upon finding that the soil in the ditch contained high levels of phosphorus, heavy metals, and PCB's, the Agency sealed the site off. This was done by the Illinois Department of Transportation (IDOT) and involved the installation of 7,000 feet of snow fence around the ditch and pond between Queeny Avenue and Judith Lane. It appeared to the Agency that soils and ground water were polluted in the area, and a detailed study was needed to assess the extent of pollution.

Purpose

The purpose of this study is to determine the hydrogeological framework at Dead Creek and to discuss possible disposal sites and their impact on ground water, surface water, soils, and plants in the area.

Method of Study

The study was primarily conducted by the Ground Water Management Section of the Division of Land/Noise Pollution Control, IEPA. Preliminary study involved the review of data in files, field work, and laboratory analysis. Adjacent land owners and businesses were contacted and permission was obtained for IEPA personnel and equipment to enter on their properties. Information was obtained from the Illinois State Geological Survey (ISGS) and the Illinois State Water Survey (ISWS) as to the general geology, and ground water conditions in the area. Local residents and officials were interviewed and a series of past aerial photographs were obtained to determine the site's history.

On September 8, 1980, the Agency's drill-rig sub-unit began to work at the site. This work included five hand auger borings, and the drilling of 12 test holes to determine the local geology and to install ground water monitoring wells. Soil samples were collected to analyze their physical and chemical properties. The ground water from the wells was sampled for quality and the potentiometric levels were recorded from time to time.

All inorganic soil and water analyses from the site was done by the IEPA Champaign Laboratory using the Inductively Coupled Argon Plasma (ICAP) emission spectrometric method. Organic soil and water analyses were done at the IEPA Springfield Laboratory using gas chromotography/mass spectometry methods. Grain size and permeability analyses for the soils, were also performed by the IEPA Champaign Laboratory according to ASTM standards.

Other Studies

At the request of U.S.EPA, Region V, the Environmental Monitoring Systems Laboratory conducted a thermal infrared survey of the subject site and its vicinity (Becker, 1981). Multispectral Scanner Data and color infrared photographs were obtained in December, 1980 and analyzed. Five active waste disposal areas and two probable, revegetated burial sites were identified from the color infrared photography (Figure 1a). Furthermore, four outfalls were detected entering the holding ponds on Cerro Copper Company's property. These were detected from the Multispectral Scanner Data.

Acknowledgements

Thanks are extended to the Emergency Action Center of the IEPA, ISGS, ISWS, IDOT, U. S. Army Corps of Engineers (USACE), U. S. Department of Agriculture (USDA), Cerro Copper Company, Mr. Reed Neuman of the Attorney General's Office, and Honer and Shifrin, Inc. for materials, assistance, and services. A special thanks is extended to Dr. Paul Hiegold of the ISGS for his assistance on field studies. The majority of field data was collected by Doug Tolan and Ken Bosie.

Site Description

Location

Dead Creek is located in the towns of Sauget and Cahokia in St. Clair County, Illinois (see Figure 1). The creek supplies drainage for part of the Mississippi River flood plain known as the American Bottoms. It starts in the town of Sauget and flows southwest through Cahokia until it discharges into the Prairie DuPont Floodway. The Floodway in turn discharges to the Cahokia Chute of the Mississippi River.

As might be expected of a flood plain, the area is typified by very little relief, and is protected against flooding by a system of levees that front the river.

The area covered by this report is outline in the square on Figure 1. Although some of the data was collected outside, the study area is the part of Dead Creek bounded by Queeny Avenue and Judith Lane.

Climate

The site is located in the northern temperate zone which is characterized by warm summers and moderately cold winters. The average annual precipitation in the area is about 38 inches (ISWS, 1965). Figure 2a shows the mean monthly averages taken at Edwardsville. The greatest amounts of rainfall occur from March through June, then a gradual monthly decline occurs until December. With the average calculated evapotranspiration given to be about 33 inches (Figure 2b), the average potential water surplus is then about 5 inches for the area in a year. Some of this surplus water will infiltrate the soil and move downward.

Site Development

Subsequent to reviewing data in files and interviewing several persons, it was concluded that a pollution problem might exist outside the realm of mere dumping into the creek itself. Local residents reported a wide variety of past waste disposal activities in the area. All had two main themes: 1) that gravel pits had existed in the past on the east side of the creek near Sauget Town Hall and 2) that some sort of waste had been buried in the pits prior to their filling.

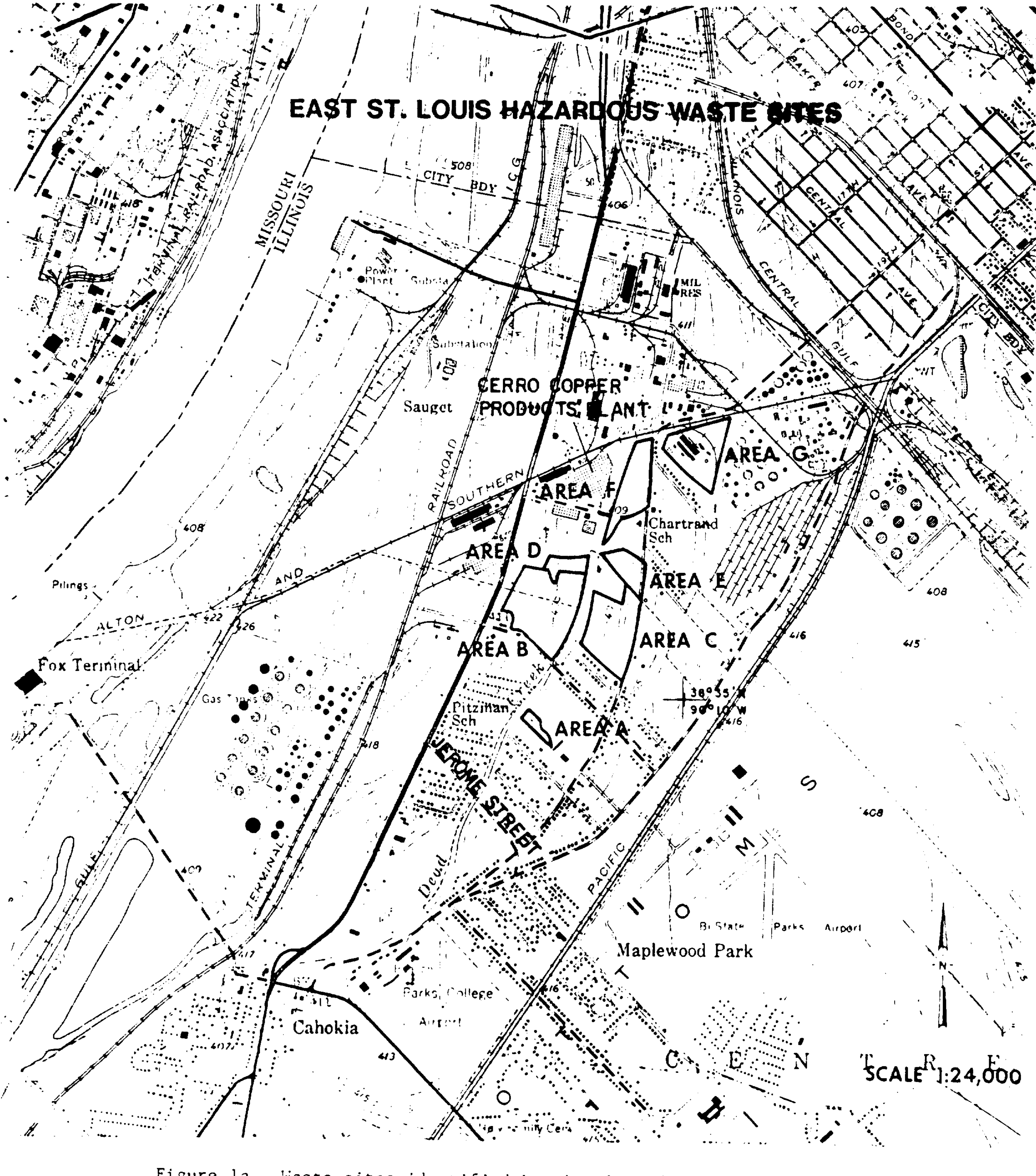


Figure 1a. Waste sites identified by the thermal infrared survey.

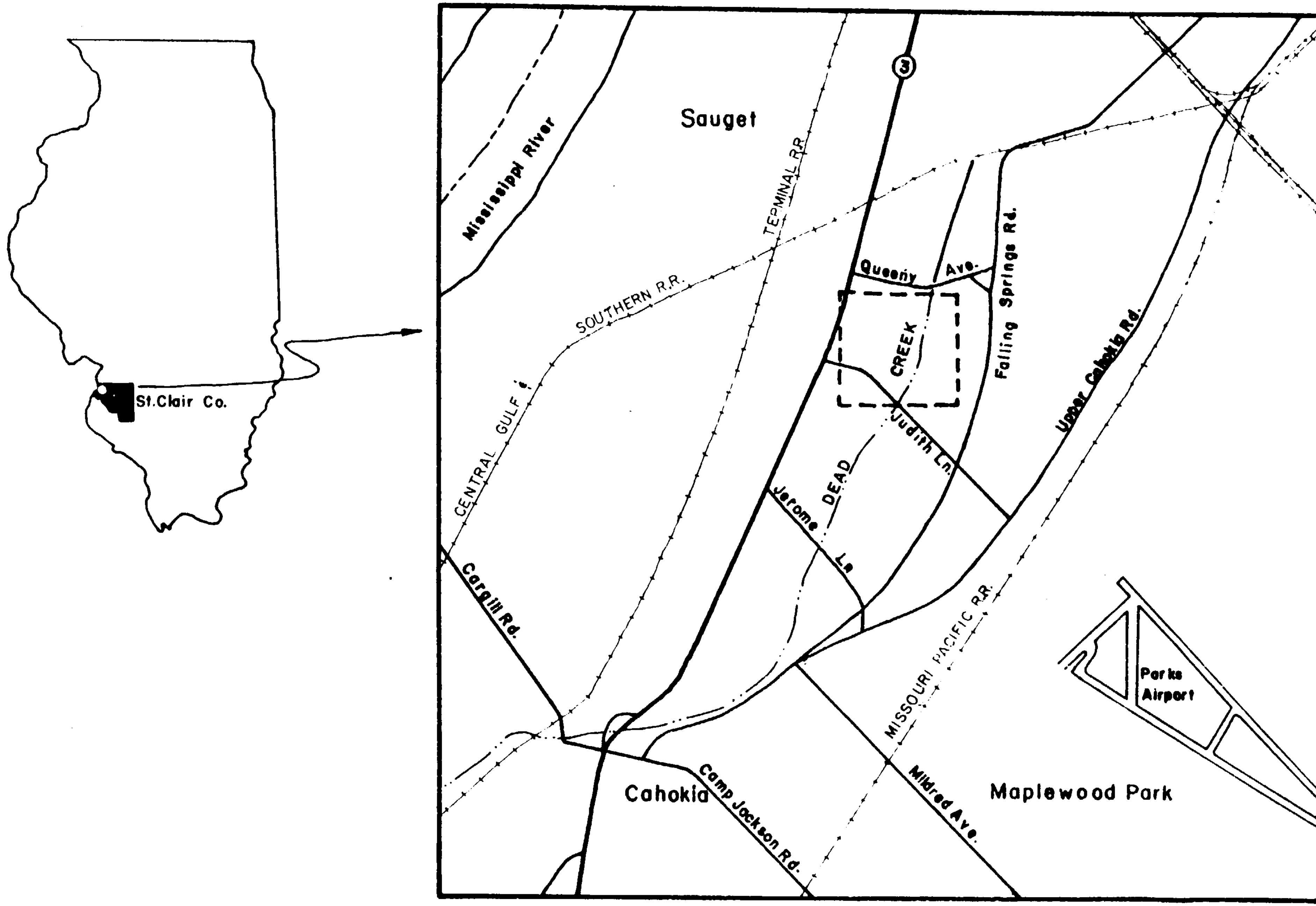
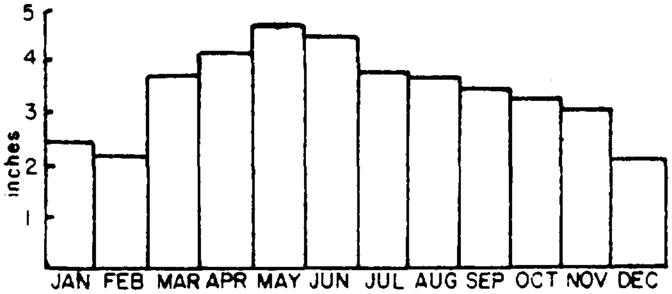
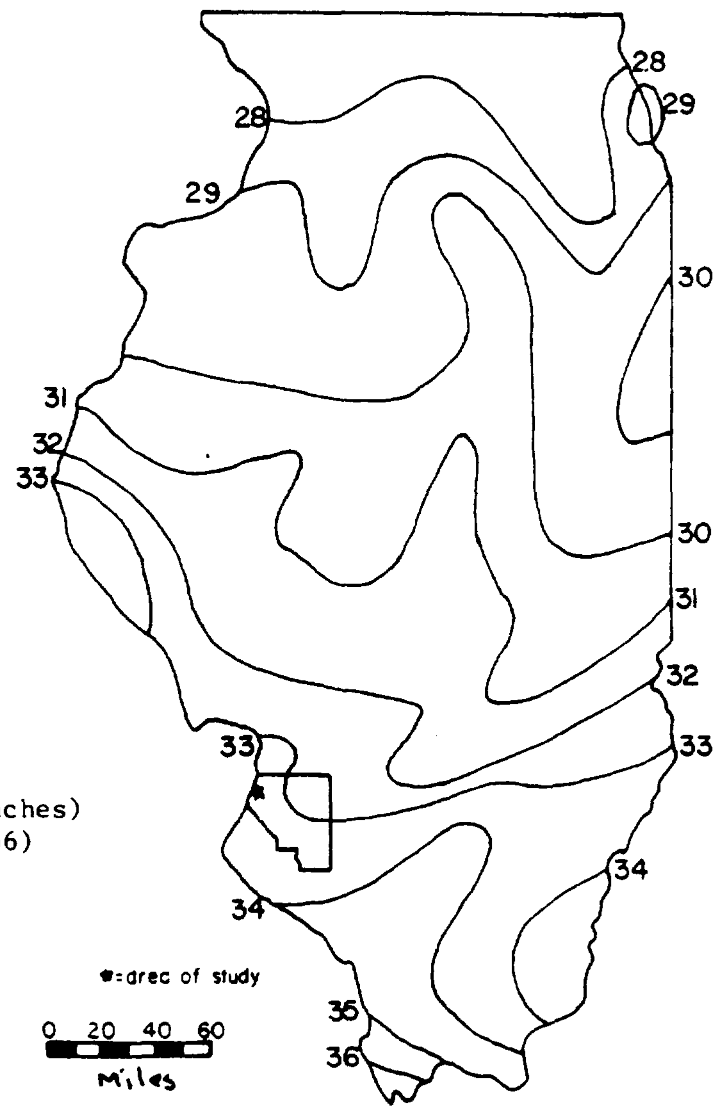


Figure 1. Location of Dead Creek and study site (square)



(a) Mean monthly precipitation at Edwardsville, Illinois (1932-1962



(b) Mean annual calculated evapotranspiration (in inches) over 45 years (Jones, 1966)

Figure 2. Climatological data

To confirm the information on these past events, a series of aerial photographs for stereo viewing was ordered for the years 1937, 1940, 1950, 1955, and 1962. From the analyses of aerial photographs and review of the file data, the following potential disposal sites were identified: an open dump, part of which was a sand pit, a holding pond at Cerro Copper, a disposal impoundment, a pond by H. H. Hall Construction Company (a former sand pit), and 3 sand pits which are now filled. Two probable disposal areas on each side of Dead Creek, identified by Becker (1981) were not supported by the aerial photographs.

1937

Figure 3a is a drawing made from aerial photographs of the area in 1937. The Figure shows a large sand pit (A) on the east side of Dead Creek with an access road leading up to Old Queeny Avenue.

1940

Figure 3b is a drawing which represents the area in 1940. The sand pit (A) has been enlarged towards the east and the access road now leads to Falling Springs Road.

1950

The next photographs were taken in 1950, a drawing of these photos is shown on Figure 3c. It is evident from the photgraphs that a great deal of change took place in ten years. The former large pit (A) has now been bisected by a berm with New Queeny Avenue built on top of it. The pit was partially filled in the eastern half, south of New Queeny Avenue, and enlarged a great deal to the north. Aside from this, four new pits were excavated. Two are north (B) and south (C) of Old Queeny Avenue along Dead Creek. One (D) is on the west side of the creek just south of New Queeny Avenue. The last is a large pit (E) dug by H. H. Hall Construction Company near Judith Lane whose access road probably became Walnut Street. In this photograph the south branch of Old Queeny Avenue has been subtended and Sauget Town Hall is under construction where the street once was.

This verifies the statements by local residents that sand pits were once located around Sauget Town Hall.

1955

The drawing (Figure 3d) from photographs taken during 1955 again show a drastic change. Sauget Town Hall is completed and is surrounded by low lying areas. These low lying areas are the result of fill materials settling in the former sand pits. At this time, the pit (B) on the east side of the creek across from Cerro Copper has yet to be completely filled. The pit (E) by Judith Lane is still unchanged.

1962

By 1962 (Figure 3e), the drawing shows that the pits once surrounding Sauget Town Hall have been filled. Settlement has developed prominent troughs in areas that were previously excavations. The only remaining pit is still the one south by Judith Lane (E).

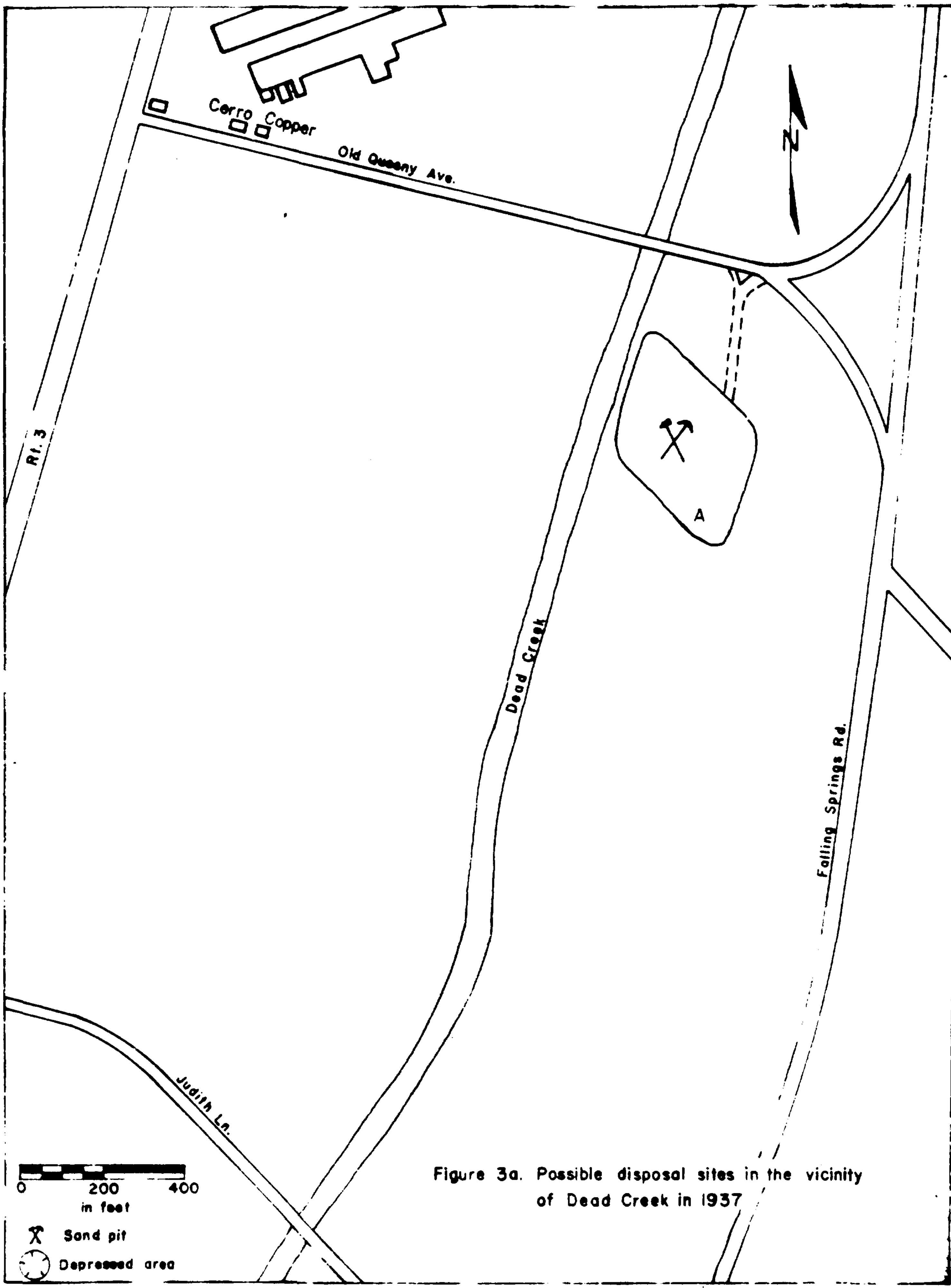


Figure 3a. Possible disposal sites in the vicinity of Dead Creek in 1937

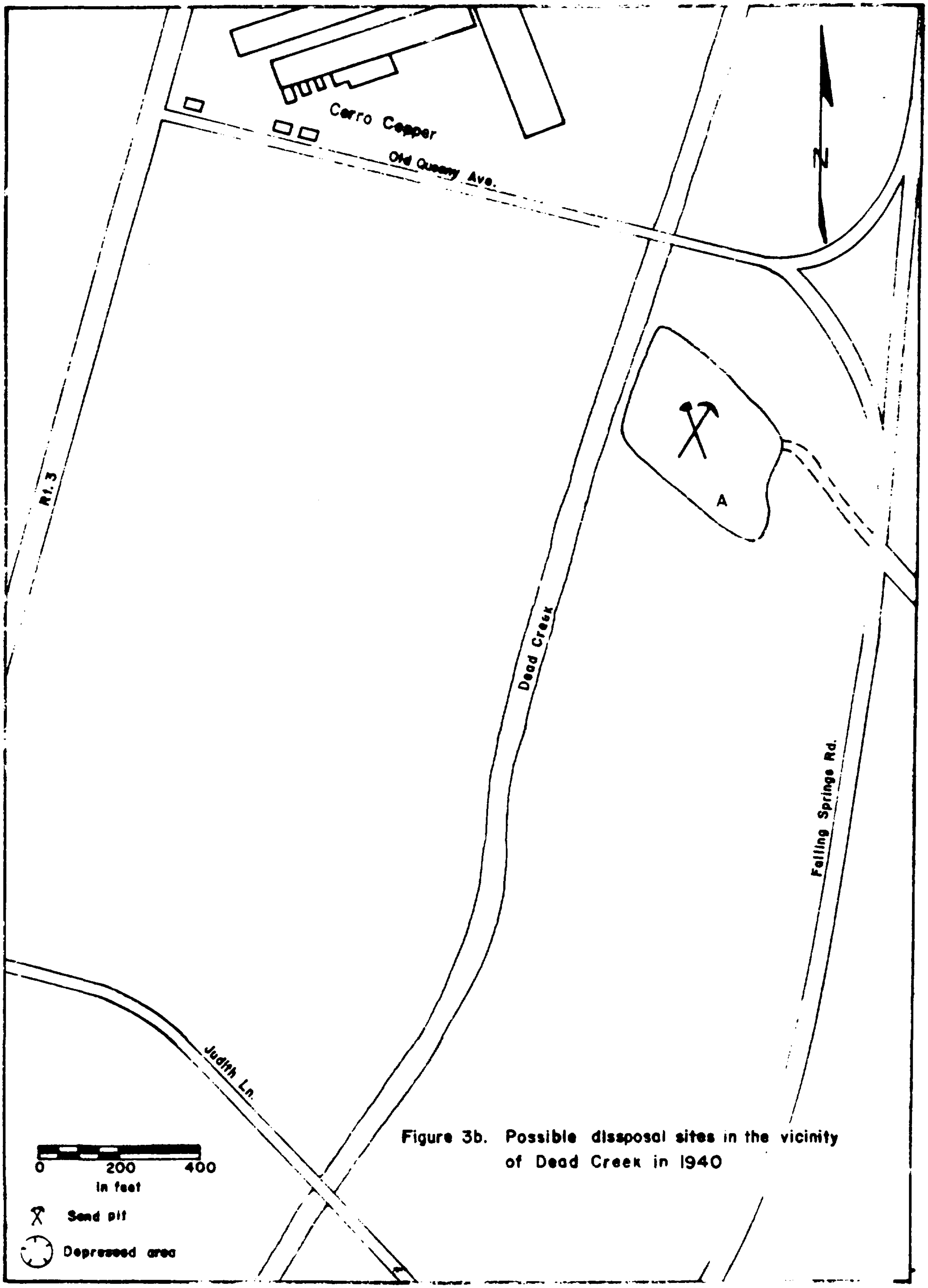


Figure 3b. Possible dissposal sites in the vicinity of Dead Creek in 1940

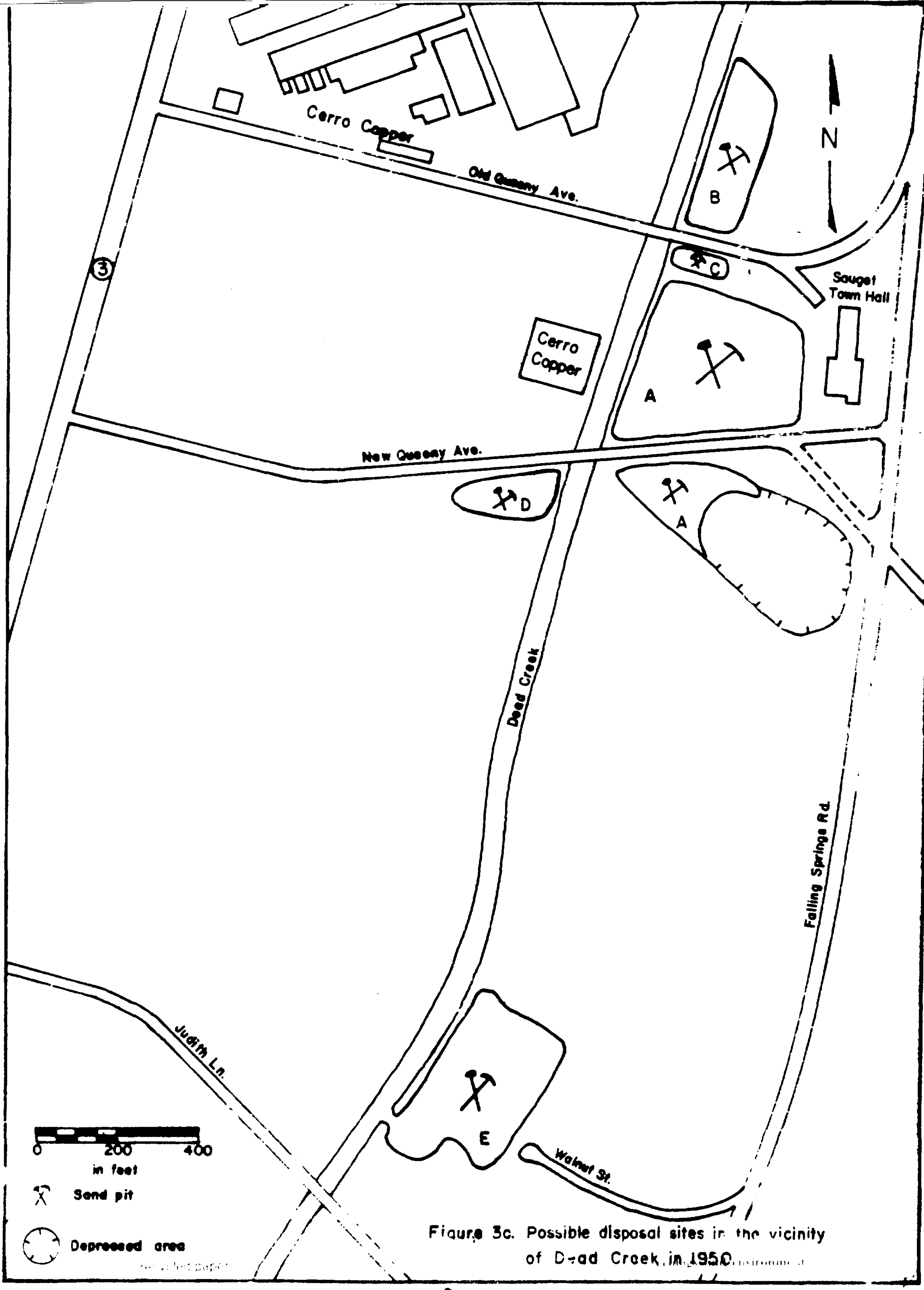


Figure 3c. Possible disposal sites in the vicinity of Dead Creek in 1950

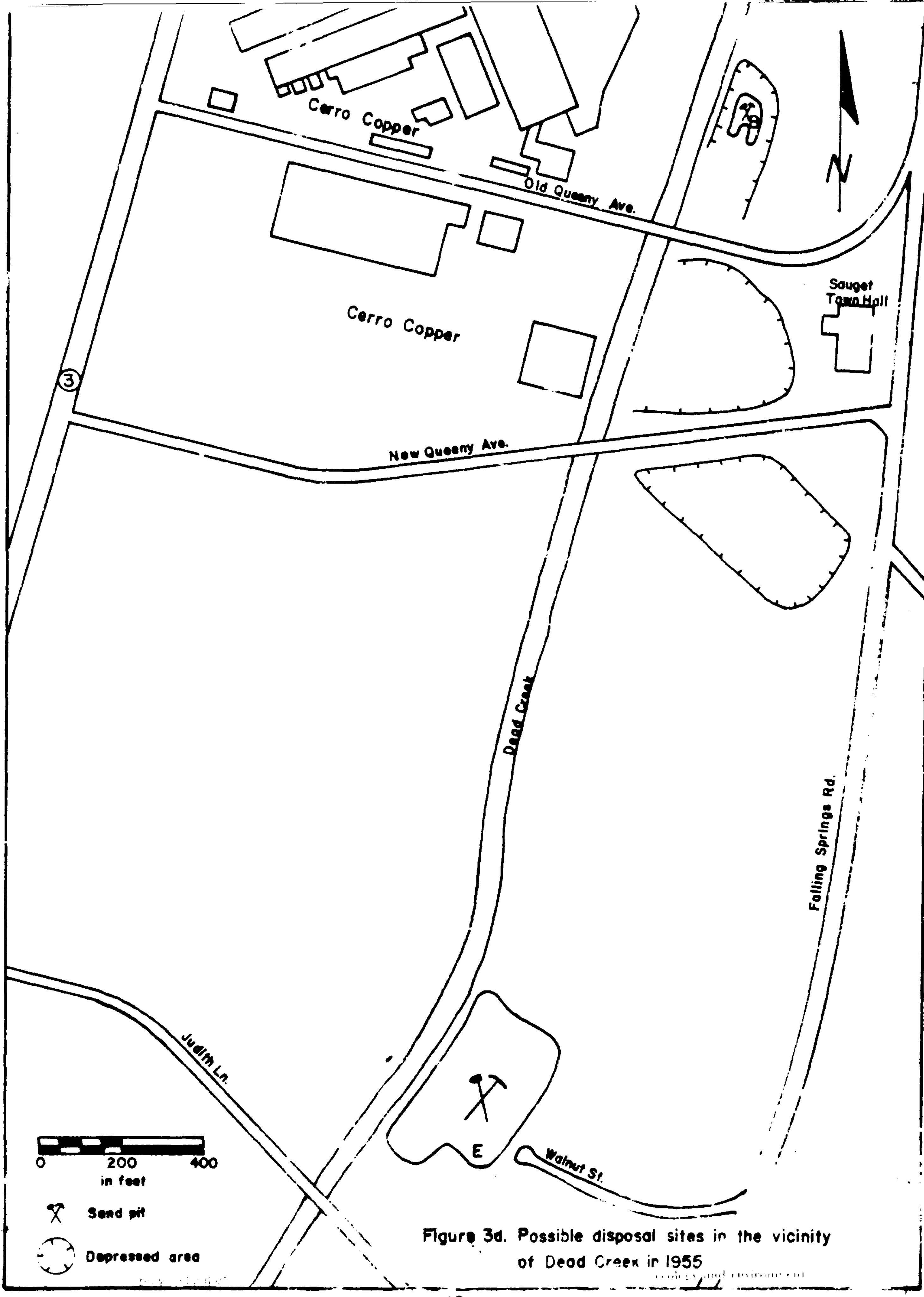


Figure 3d. Possible disposal sites in the vicinity of Dead Creek in 1955

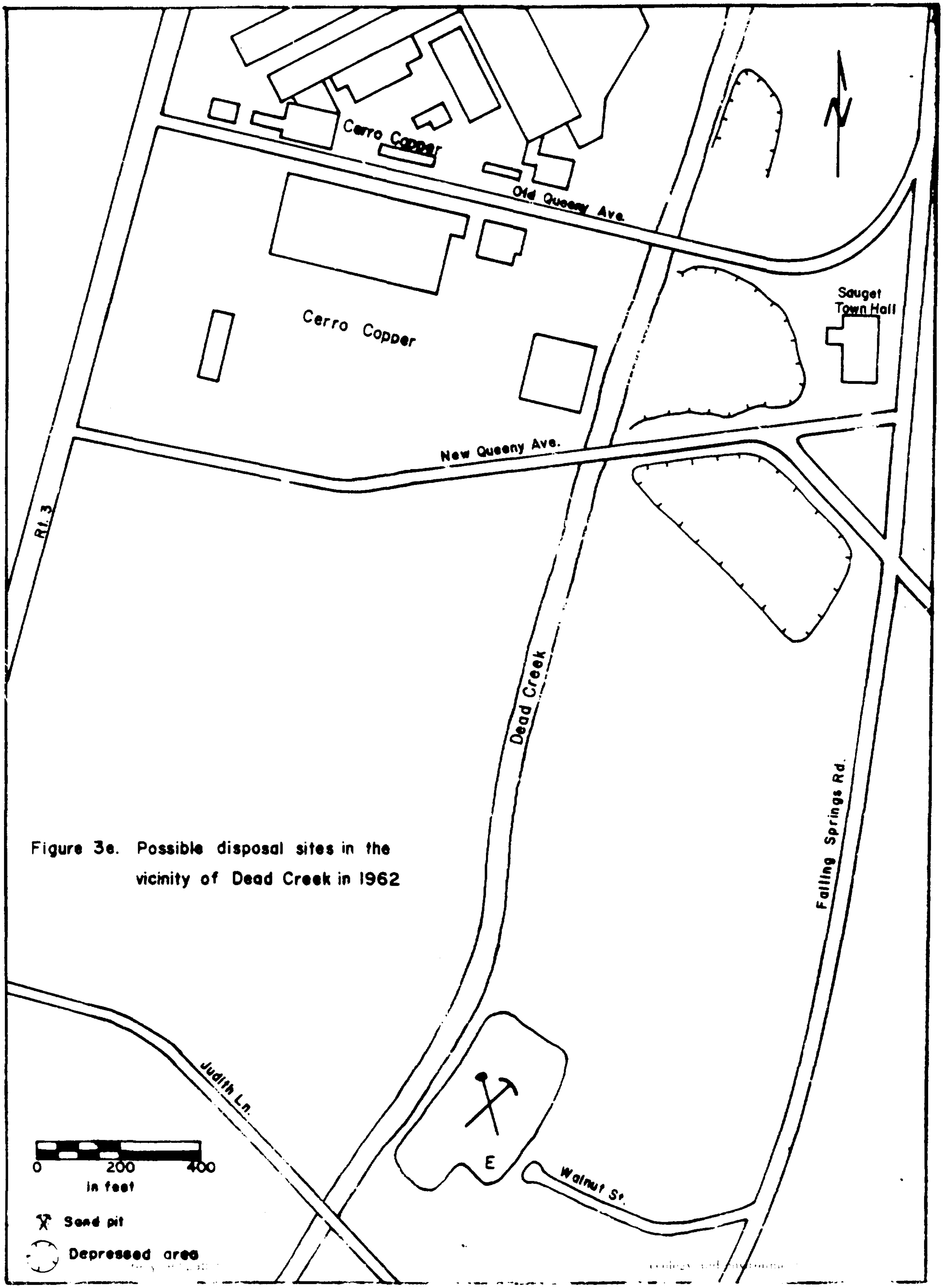


Figure 3e. Possible disposal sites in the vicinity of Dead Creek in 1962

1973

Figure 3f was drawn from a map of the East St. Louis area developed by the USACE. It shows the location of Harold Waggoner and Company, a trucking firm which specialized in hauling industrial wastes.

Mr. Waggoner operated the company from 1964 to 1974 when he sold out to Ruan Trucking Company. Prior to August 6, 1971, Mr. Waggoner made a practice of washing his waste hauling trucks out and discharging the contents into Dead Creek (IEPA files). At this time, he was ordered by the IEPA to stop such practices and inform the Agency of his plans for future operation. This is when the disposal impoundment pictured in Figure 3f was put into use. Disposal into this impoundment only served to turn surface water pollution into ground water pollution. Ruan Trucking Company is said to have continued this practice until 1978 when they leased the property to Metro Construction Company who subsequently covered it up. (Personal communication, Attorney General's Office).

Other possible sources of pollution at the creek

At the time of writing, the only other known source of discharge into the creek was that by Midwest Rubber Company. From the late 1940's to the early 1960's they had a pipeline leading from their factory on Illinois Route 3 to the creek. It discharged wastes from their manufacturing process, which included rubber, into the creek. These wastes most likely account for the "bed spring" effect when one walks in the creek bottom.

Field Work

Aerial photographs of the site would not arrive until the drilling phase of the investigation was completed. It was felt, then, that geophysical methods might be employed to determine the location, size, and depth of the pits, and whether they contained drums. It was obvious while at the site that portions of it had slightly subsided. These sunken areas were felt to be where former pits could have been (later proven correct by the aerial photos). If drums had been buried in them it was reasonable that a metal detector survey might determine these locations. This proved to be fruitless as the fill, and the area in general, consisted mostly of demolition wastes containing large amounts of metal. Since electrical resistivity is affected by metal, it was rendered useless as well. A seismic survey run by the ISGS was the only other means of obtaining information about the pits. Unfortunately, the data from the seismic profile was inconclusive due to interference (noise) by local industry and traffic. Thus, none of the geophysical methods employed was useful. Specifications of geophysical instruments are in Appendix 3.

Following the geophysical investigation, five had auger borings and 12 test holes were drilled. The 12 test holes were later implaced with ground water monitoring wells. The location of these monitoring wells, along with the hand auger borings, and local topography are shown on Figure 4.

Appendix 1 is boring log and monitor well information and Appendix 2 contains selected grain size distribution and permeability data from these borings. The class limits scale used was a modified Wentworth-Lane (Pettijohn, 1975) and the textural terminology was that used in Figure A-1. The monitor well depth ranged from 28 to 40 feet and all were finished in the Henry Formation Sands. They were slotted from at least five feet above the water table to the base. None of the holes reached bedrock. The hand auger borings in the creek bottom

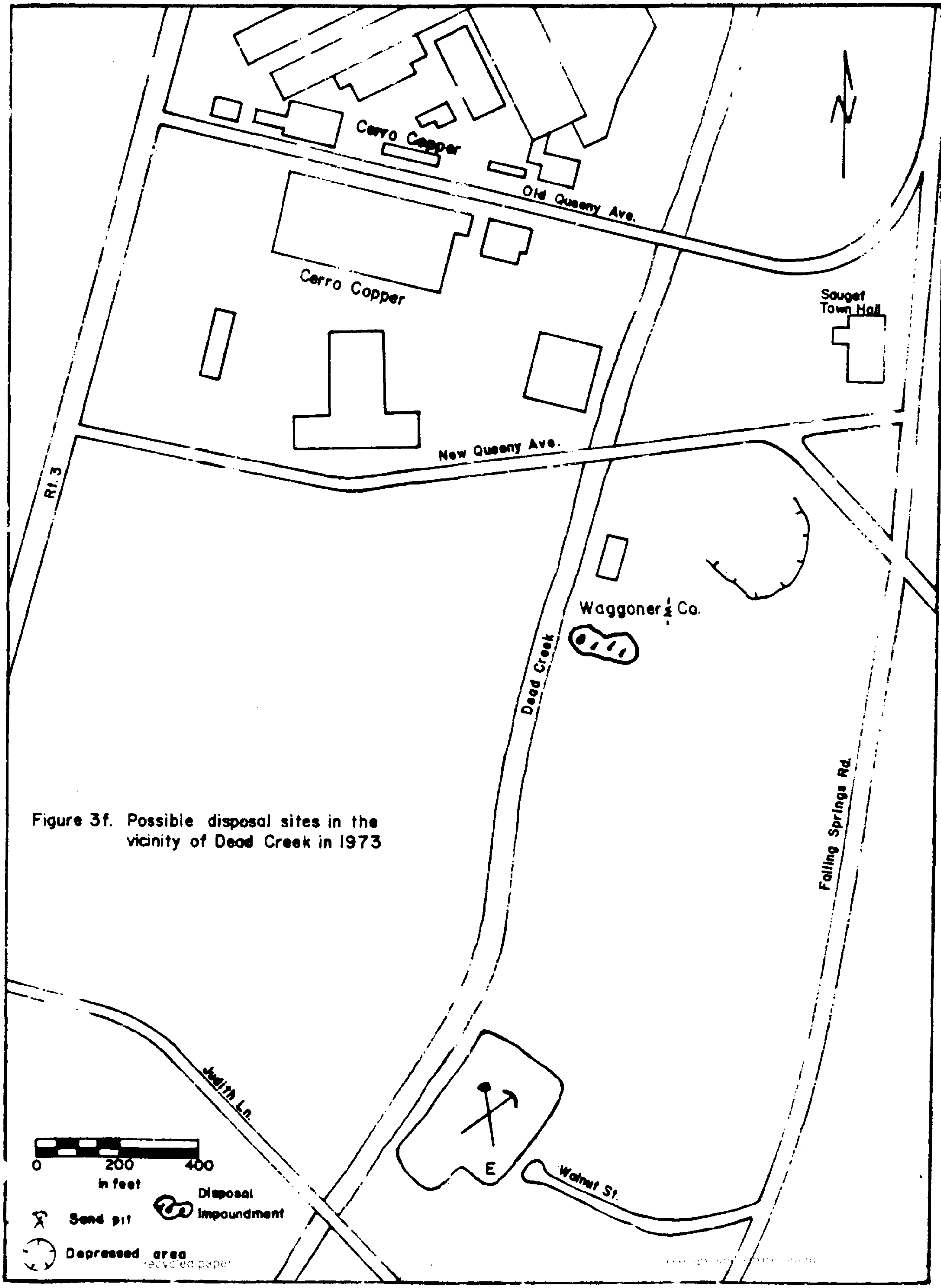


Figure 3f. Possible disposal sites in the vicinity of Dead Creek in 1973

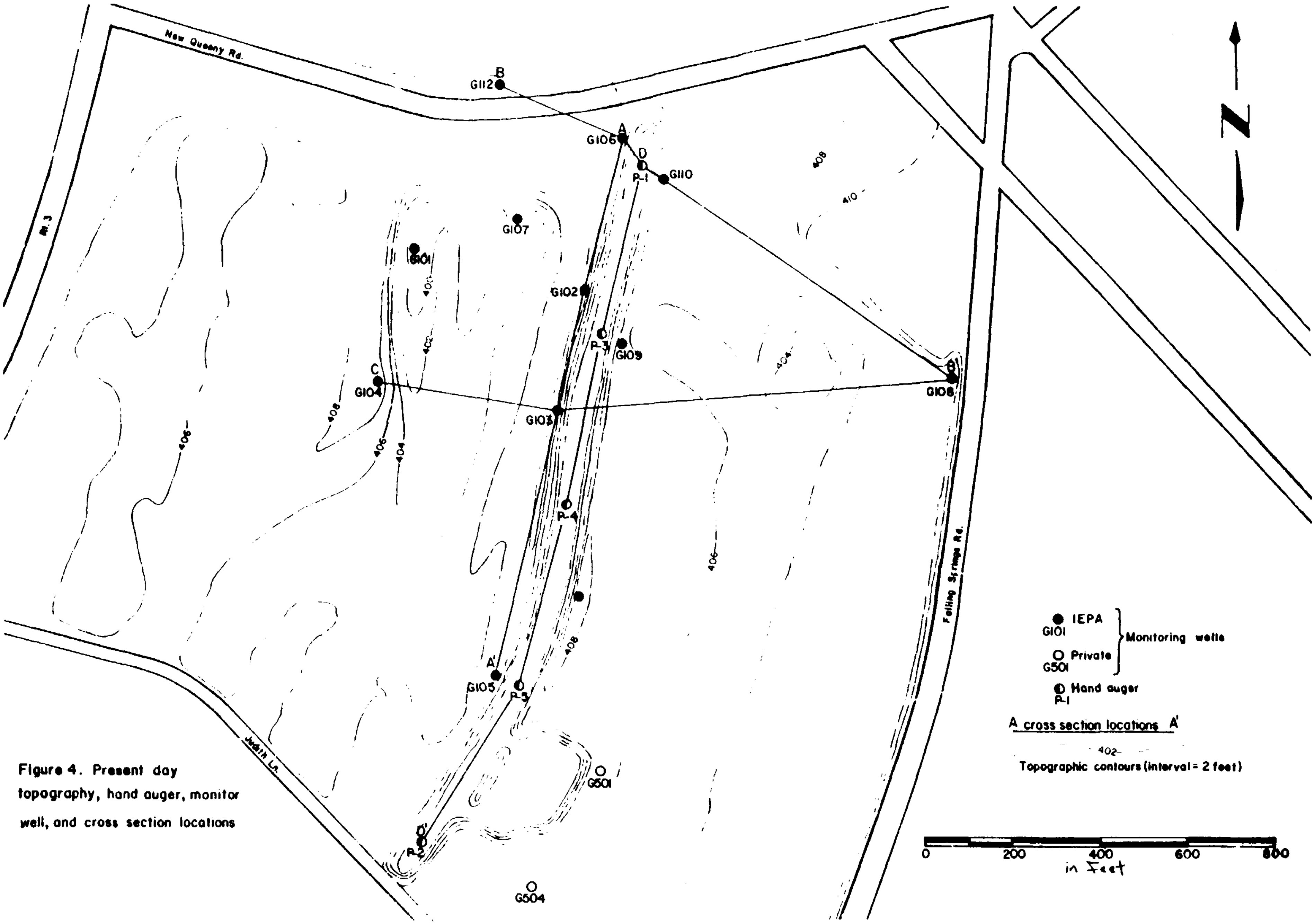


Figure 4. Present day topography, hand auger, monitor well, and cross section locations

were made to determine the thickness of the fill material. They ranged from 8 to 10 feet in depth and were finished upon reaching the Henry Formation Sands.

Geology

Dead Creek is situated in the Mississippi River flood plain on thick valley fill deposits (100'+). The valley fill is comprised of two formations, one of which is a thin mantle called the Cahokia Alluvium. Derived from the erosion of till and loess, the alluvium consists of unconsolidated, poorly sorted, silt, with some local sand and clay lenses. It appears to have accumulated in valleys during flood intervals after the Wisconsinan glaciers had retreated.

The Cahokia Alluvium formation unconformably overlies the Mackinaw Member of the Henry Formation. The Henry Formation is Wisconsinan glacial outwash in the form of valley train deposits. It accounts for the majority of the valley fill and is composed of sand and gravel that coarsens with depth. Due to the thickness and water capacity of this formation, it is a major aquifer for the East St. Louis area.

Mississippian limestone underlies the valley fill deposits at a depth of approximately 120 feet (Bergstrom, 1956).

Site Geology

Based on the 12 test holes, 5 hand auger borings, and the ISGS publications, a generalized rock stratigraphic column for shallow depths is shown in Figure 5. Cross sections (Figures 6a and 6b) show that geology at this site corresponds to the general description of the area previously given. The location of these cross sections appear on Figure 4.

Data from the 12 test holes indicates that the Henry Formation sand, which extends to bedrock, is overlain by the Cahokia Alluvium. The thickness of the alluvium is between 6 and 17 feet in the test holes and becomes thinner toward the east. The alluvium is primarily composed of silt with local clay and sand lenses, and also shows a tendency to be sandy at the base.

The Henry Formation is a major aquifer for the area and the portions sampled by the IEPA showed it to be an arkosic, gray, fine to medium grained sand. Former sand pits in the area were excavated to attain these sands.

Permeability values measured in the laboratory (Appendix 2), are in the order of 7×10^{-6} cm/sec and 4.4×10^{-3} cm/sec for the Cahokia Alluvium and Henry sands, respectively. Vertical distribution of permeability values are in Figure 6a.

Hand auger borings P-1 through P-5 were made in the creek bottom and they show that the material there is a fill composed of loosely compacted silty clay to clayey silt (Figure 6b). Because the velocity of creek flow was great enough to erode vertically at one time, a scouring in the creek through the upper silt mantle into the sand occurred. At a later date the energy of the stream decreased and the clayey silt now seen in the bottom of the creek was filled down into the Henry Formation sands. This deposit, since it is less consolidated than the older materials bounding it, is felt to have a permeability in the range of 1.0×10^{-6} cm/sec.

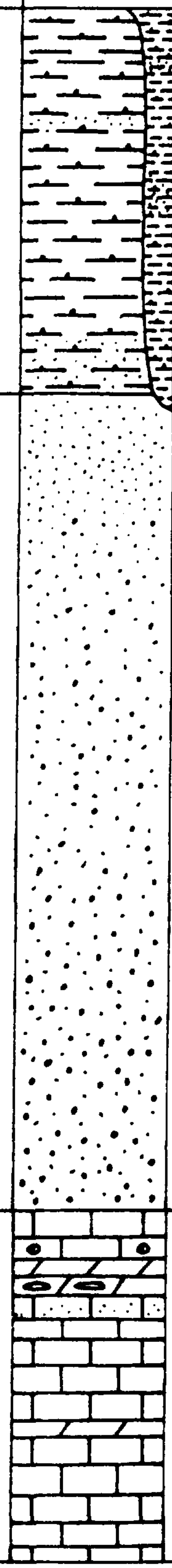
System	Series	Stage	Formation	Column	Thickness (in ft)	Description
Quaternary	Pleistocene	Holocene	Cahokia Alluvium		6-20	Silt, light tan, w/clay and fine sand locally, micaceous.
		Wisconsinan	Henry		100-114	Sand, tan, arkosic, fine grained at top coarsening downward to include some fine to medium grained gravel. Subrounded, moderately sorted. Contains: Quartz, chert, feldspars, limestone, ferromagnesian minerals, shell fragments; wood chips and coal fragments at top.
		Group				
Mississippian	Valmeyeran	Middle Valmeyeran			100+	Limestone

Figure 5. Generalized Geologic Column for unconsolidated deposits to bedrock in the Dead Creek area.

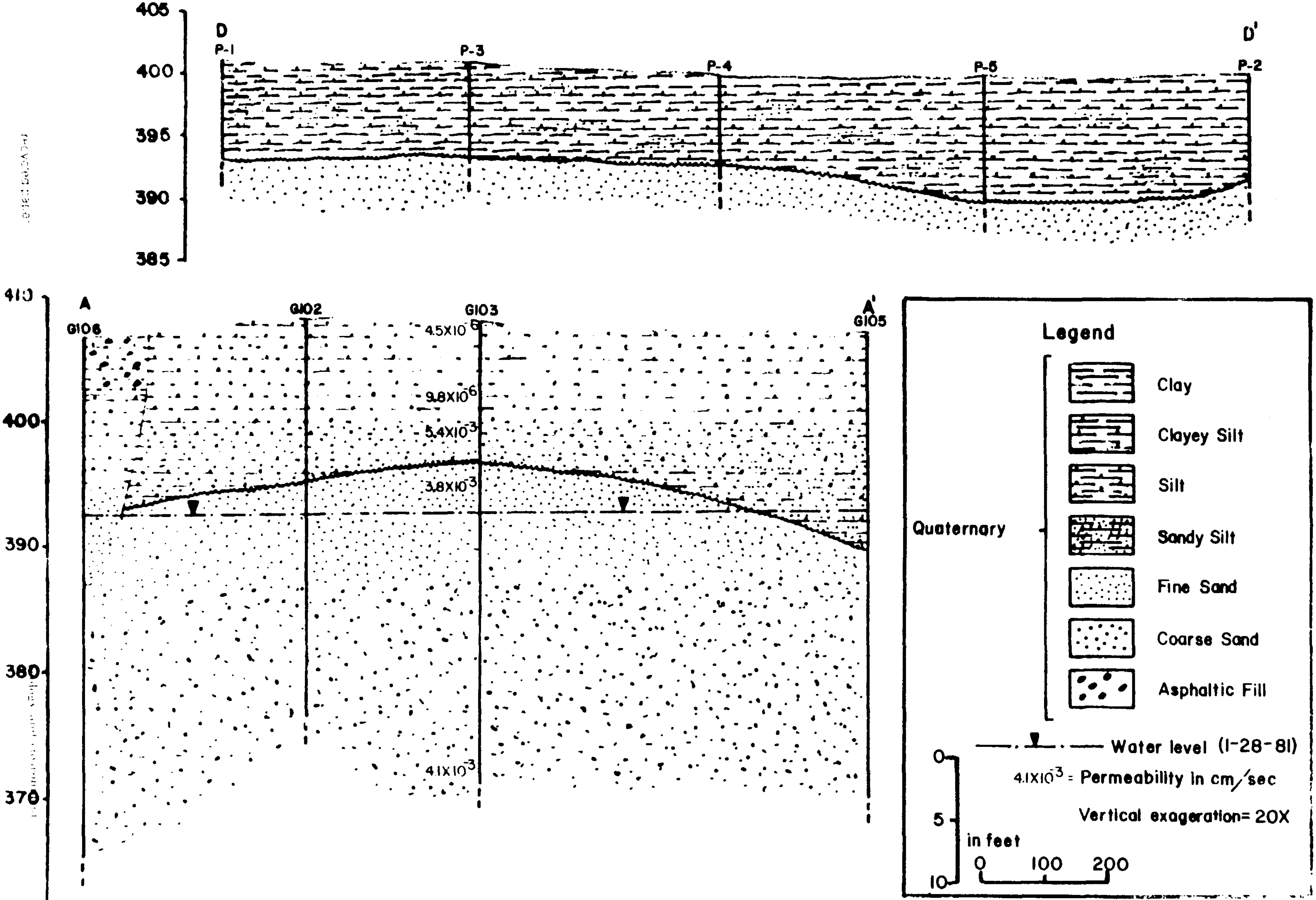
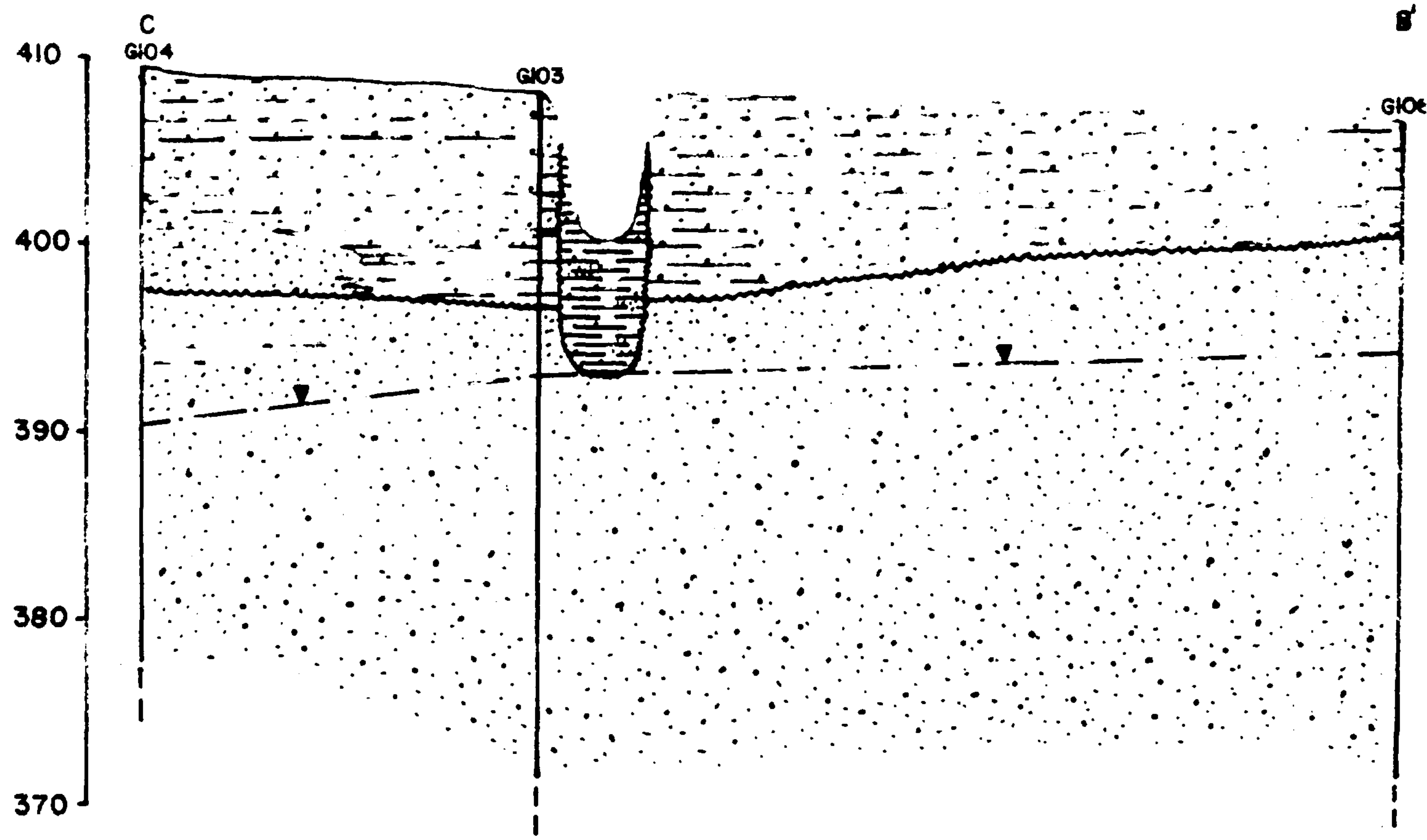


Figure 6a Geologic Cross Sections at Dead Creek (see Figure 2 for locations)



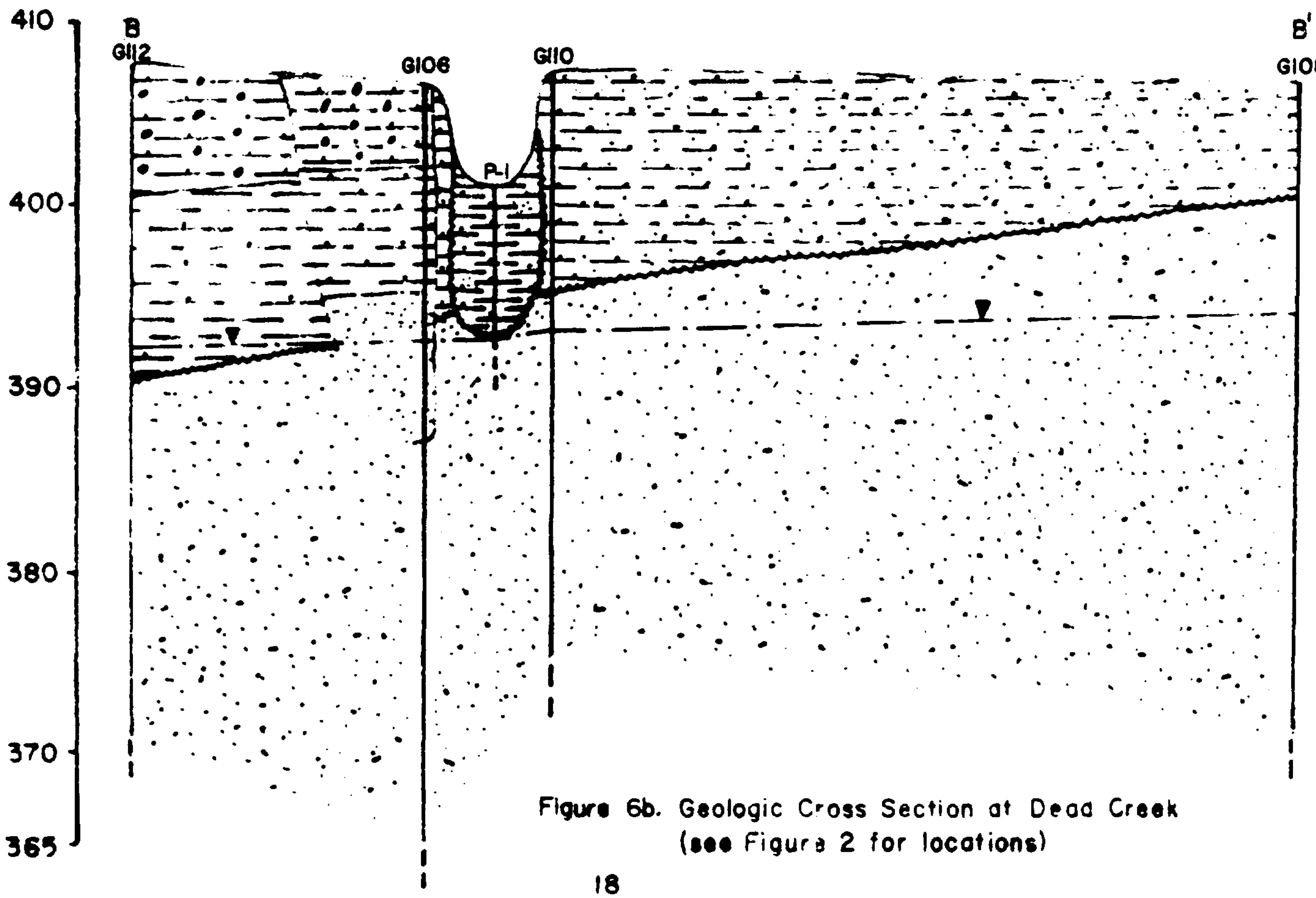


Figure 6b. Geologic Cross Section at Dead Creek
(see Figure 2 for locations)

Chemical Analyses of Soil

The soils adjacent to and in Dead Creek were sampled extensively to assess the impact of disposal practices. Results were evaluated to determine horizontal and vertical distribution of contaminants. The location of these samples is given in Figure 8 and analyses appear on Table 1. A general description of the soil analyses for Dead Creek is: 1) high concentrations of organics in the north end of the creek by New Queeny Avenue, 2) high concentrations of inorganics in the south away from New Queeny Avenue, and 3) slight vertical migration of inorganics and PCB from the surficial soils into the underlying sand deposits.

Surficial soils

Chemical analyses from surficial soil samples are listed in Table 1. In addition, the analyses of soil samples in monitoring wells G106, G107, and hand auger boring P-1 are discussed and presented in Figures 7a, 7b, and 7c. Over all, 31 soil samples were analyzed in the area, and sampling locations are shown in Figures 2 and 8.

Outside the boundaries of the creek bed itself five surficial soil samples, X119, X120, X121, G106, and G107, were taken and analyzed in an attempt to locate outside dumping sources. Analyses of these samples show relatively low concentrations of chemicals with the exception of PCB, which is .62 ppm, 1.1 ppm and 80 ppm at G107, X119, and X120 respectively. These samples lie in areas where past dumping of wastes is suspected.

The analysis of X121 had the lowest concentrations of chemicals when compared to all the other soil samples in the study. In fact, it showed the lowest concentrations of barium, cadmium, chromate, copper, lead, nickel, silver, sodium, strontium, and vanadium. Therefore, this sample is considered to be representative of background quality for soil in the area.

Surficial soil sampling outside the area of Dead Creek also took place in the holding ponds behind Cerro Copper's recycling plant. These ponds at one time were the head waters to Dead Creek. When flow was restricted under New Queeny Avenue, the creek was graded to the north so water would drain to a catch basin installed by Monsanto. The water entering this catch basin is then pumped to the Cahokia sewage treatment plant. Full restriction of flow under New Queeny Avenue is somewhat suspect as IEPA personnel have observed water flowing from the plug downstream in the creek. Since there is a storm sewer in the culvert it could account for this flow, but the possibility of the holding ponds backing up to cause flow must also be taken into consideration. Whatever the case might be, it is obvious that these holding ponds are highly polluted. Sediment samples X128 and X129 (Table 1) taken in them show PCB, aliphatic hydrocarbons, dichlorobenzene, silver and high concentrations of nickel, lead, cadmium, arsenic, copper, and manganese. In addition, the highest chromate concentration of 491 ppm was found in X129.

Sometime after 1950 the culvert at Judith Lane was blocked, but after reaching an undetermined level, it does flow. Water then moves downstream as shown in Figure 8 to the Prairie DuPont Floodway. IEPA personnel have sampled the soils from the creek along its path to the Floodway and the analyses appear in Table 1. When downstream soil samples X101, X102, X103, X104, and X105 are compared to the background soil sample X121 (Table 1) it is seen that they contain relatively high concentrations of aluminum, barium, boron, cadmium, chromate, copper, lead,

Table 1. Chemical analysis of soils (in ppm, dry weight material)

Parameters	Sample number						
	X101	X102	X103	X104	X105	X106	X107
Aluminum	12,000	NA	NA	NA	NA	NA	NA
Arsenic	26.0	NA	NA	NA	NA	NA	6,000
Barium	1,300	4,700	210	390	475	NA	4,800
Berylium	<4.0	3.0	<0.5	2.0	<1.0	NA	< 1.0
Boron	<10.0	76.0	< 10.0	<10.0	<10.0	NA	NA
Cadmium	<40.0	50.0	8.0	31.0	2.0	NA	70.0
Calcium	24,000	5,300	210,000	16,000	13,000	NA	11,000
Chromium	400	50.0	60.0	50.0	< 50.0	NA	360
Cobalt	40.0	32.0	6.0	8.0	9.0	NA	30.0
Copper	15,000	17,200	320	1,800	360	NA	32,000
Iron	57,000	110,000	11,000	19,000	18,000	NA	70,000
Lead	800	1,300	260	250	75.0	NA	2,400
Magnesium	7,100	2,000	10,000	5,100	3,300	NA	2,900
Manganese	600	170	210	160	200	NA	150
Mercury	1.2	NA	NA	NA	NA	NA	NA
Nickel	2,000	2,300	45.0	600	<50.0	NA	3,500
Phosphorus	NA	6,200	720	1,200	4,200	NA	7,040
Potassium	2,400	900	1,400	2,100	1,400	NA	1,200
Silver	< 100	45.0	10.0	< 10.0	< 10.0	NA	40.0
Sodium	800	1,100	100	190	125	NA	1,700
Strontium	100	140	210	47.0	43.0	NA	180
Vanadium	<80.0	50.0	22.0	31.0	35.0	NA	60.0
Zinc	12,000	21,000	900	5,600	780	NA	25,000
PCB	.120	.120	2.8	2.0	< .050	5,200	120
Aliphatic hydrocarbons	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Alkylbenzenes	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chloronitrobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Dichlorophenol	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Hydrocarbons	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Naphthalenes	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Trichlorobenzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL

Table 1. Chemical analysis of soils (in ppm, dry weight material) (cont)

Parameters	Sample number						
	X108	X109	X110	X111	X112	X113	X114
Aluminum	8,000	9,100	7,000	8,000	6,600	10,000	6,400
Arsenic	44.0	25.0	67.0	80.0	50.0	300	23.0
Barium	3,800	1,600	4,300	1,800	8,000	2,400	1,600
Berylium	<4.0	<4.0	<4.0	<5.0	<5.0	<5.0	<3.0
Boron	<10.0	<10.0	<10.0	<15.0	<15.0	NA	<7.0
Cadmium	<30.0	200	40.0	100	100	400	<10.0
Calcium	10,000	24,000	16,000	13,000	30,000	11,000	14,000
Chromium	300	<40.0	140	50.0	50.0	250	400
Cobalt	30.0	20.0	<20.0	<30.0	30.0	100	<20.0
Copper	31,000	7,700	22,000	15,000	41,000	3,800	4,800
Iron	58,000	75,000	67,000	68,000	52,000	365,000	55,000
Lead	2,000	1,700	2,000	2,000	5,100	3,600	2,000
Magnesium	3,900	3,600	4,100	4,000	4,000	4,000	2,800
Manganese	150	300	200	160	300	120	130
Mercury	1.7	3.0	3.3	3.2	6.0	30	1.7
Nickel	3,000	900	1,900	2,000	2,700	2,500	1,700
Phosphorus	NA	NA	NA	NA	NA	NA	NA
Potassium	1,500	1,700	1,300	1,600	1,200	1,400	1,300
Silver	<80.0	<50.0	<90.0	<50.0	<100	<100	<70.0
Sodium	900	900	700	1,000	1,600	2,800	700
Strontium	200	130	160	160	430	180	140
Vanadium	<70.0	<80.0	70.0	100	<50.0	<100	<50.0
Zinc	22,000	27,000	25,000	47,000	52,000	61,000	20,000
PCB	NA	NA	NA	NA	NA	NA	NA
Aliphatic hydrocarbons	NA	NA	NA	NA	NA	NA	NA
Alkylbenzenes	NA	NA	NA	NA	NA	NA	NA
Dichlorobenzene	NA	NA	NA	NA	NA	NA	NA
Dichlorophenol	NA	NA	NA	NA	NA	NA	NA
Hydrocarbons	NA	NA	NA	NA	NA	NA	NA
Naphthalenes	NA	NA	NA	NA	NA	NA	NA
Trichlorobenzene	NA	NA	NA	NA	NA	NA	NA

Table 1. Chemical analysis of soils (in ppm, dry weight materials) (cont)

Parameters	Sample number X115	X116	X117	X118	X119	X120	X121
Aluminum	9,000	9,000	1,300	1,200	NA	NA	NA
Arsenic	18.0	9.0	16.0	15.0	NA	NA	NA
Barium	3,400	300	400	1,600	510	1,200	230
Berylium	<7.0	<2.0	<2.0	<2.0	1.0	1.0	<1.0
Boron	<20.0	<20.0	<10.0	6.0	<10.0	<10.0	<10.0
Cadmium	120	<20.0	<30.0	<20.0	7.0	3.0	1.0
Calcium	11,000	5,000	1,600	6,000	7,300	72,000	11,000
Chromium	120	130	<40.0	<30.0	36.0	38.0	<10.0
Cobalt	40.0	<10.0	<20.0	<4.0	9.0	10.0	9.0
Copper	22,000	270	160	1,000	100	150	100
Iron	40,000	12,000	2,400	4,300	17,500	16,200	16,500
Lead	3,200	80.0	<40.0	100	43.0	60.0	<20.0
Magnesium	5,000	2,600	1,200	1,000	4,500	4,300	5,900
Manganese	150	60	40.0	50.0	260	350	370
Mercury	4.0	0.2	2.0	2.0	NA	NA	NA
Nickel	2,400	140	<20.0	<15.0	<10.0	80.0	120
Phosphorus	NA	NA	NA	NA	NA	NA	NA
Potassium	1,500	2,300	850	1,200	1,800	1,200	1,500
Silver	<100	<50.0	50.0	<50.0	<10.0	<10.0	<10.0
Sodium	1,100	360	150	180	110	225	80.0
Strontium	200	40.0	<30.0	<30.0	42.0	140	32.0
Vanadium	150	<50.0	<40.0	<50.0	27.0	27.0	25.0
Zinc	71,000	2,500	<50.0	300	2,000	700	230
PCB	NA	NA	NA	NA	1.1	80.0	<.05
Aliphatic hydrocarbons	NA	NA	NA	NA	BDL	BDL	BDL
Alkylbenzenes	NA	NA	NA	NA	BDL	BDL	BDL
Dichlorobenzene	NA	NA	NA	NA	BDL	BDL	BDL
Dichlorophenol	NA	NA	NA	NA	BDL	BDL	BDL
Hydrocarbons	NA	NA	NA	NA	BDL	BDL	BDL
Naphthalenes	NA	NA	NA	NA	BDL	BDL	BDL
Trichlorobenzene	NA	NA	NA	NA	BDL	BDL	BDL

Table 1. Chemical analysis of soils (in ppm, dry weight materials) (cont)

Parameters	Sample number							
	X122	X123	X124	X125	X126	X127	X128	X129
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	29.5	95.8
Barium	5,500	4,400	350	2,500	5,000	2,500	NA	NA
Berylium	2.0	3.0	1.0	< 1.0	2.0	2.0	NA	NA
Boron	<10.0	<10.0	25.0	<10.0	76.0	<10.0	NA	NA
Cadmium	35.0	40.0	4.0	6.0	70.0	50.0	50.6	22.11
Calcium	15,000	12,500	4,500	6,900	19,000	8,000	NA	13,095
Chromium	50.0	150	50.0	50.0	100	340	140	491
Cobalt	15.0	15.0	7.0	9.0	50.0	30.0	NA	NA
Copper	21,900	18,700	4,500	1,000	44,800	28,000	5.5	24,324
Iron	50,000	49,000	13,500	7,000	107,000	63,000	29,535	51,911
Lead	1,700	1,400	130	260	2,000	1,700	843	2,604
Magnesium	3,800	3,400	3,500	380	3,700	2,700	NA	2,088
Manganese	190	200	80.0	45.0	280	150	141	245
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	1,700	1,600	590	130	3,000	NA	569	1,474
Phosphorus	NA	NA	NA	2,000	8,900	4,700	NA	NA
Potassium	960	950	1,000	770	860	1,000	NA	NA
Silver	30.0	30.0	6.0	< 10.0	100	40.0	29.0	98.0
Sodium	630	650	100	80	1,400	700	NA	NA
Strontium	190	175	27.0	50.0	300	130	NA	NA
Vanadium	45.0	42.0	19.0	13.0	85	45.0	NA	NA
Zinc	19,900	17,700	2,600	1,500	62,000	28,000	NA	NA
PCB	540	1,100	24.0	10,000	350	73.0	2.2	13.0
Aliphatic hydrocarbons	BDL	BDL	BDL	BDL	BDL	BDL	13.0	26.0
Alkylbenzenes	BDL	BDL	BDL	370	BDL	BDL	BDL	BDL
Dichlorobenzene	0.35	23.0	BDL	660	BDL	BDL	BDL	1.7
Dichlorophenol	BDL	BDL	BDL	170	BDL	BDL	BDL	BDL
Hydrocarbons	BDL	BDL	BDL	21,000	BDL	BDL	BDL	BDL
Naphthalenes	BDL	BDL	BDL	650	BDL	BDL	BDL	BDL
Trichlorobenzene	BDL	BDL	BDL	78	BDL	BDL	BDL	BDL

NA - not attempted
BDL - below detection limit
All samples taken between 9/8/80 and 11/26/80

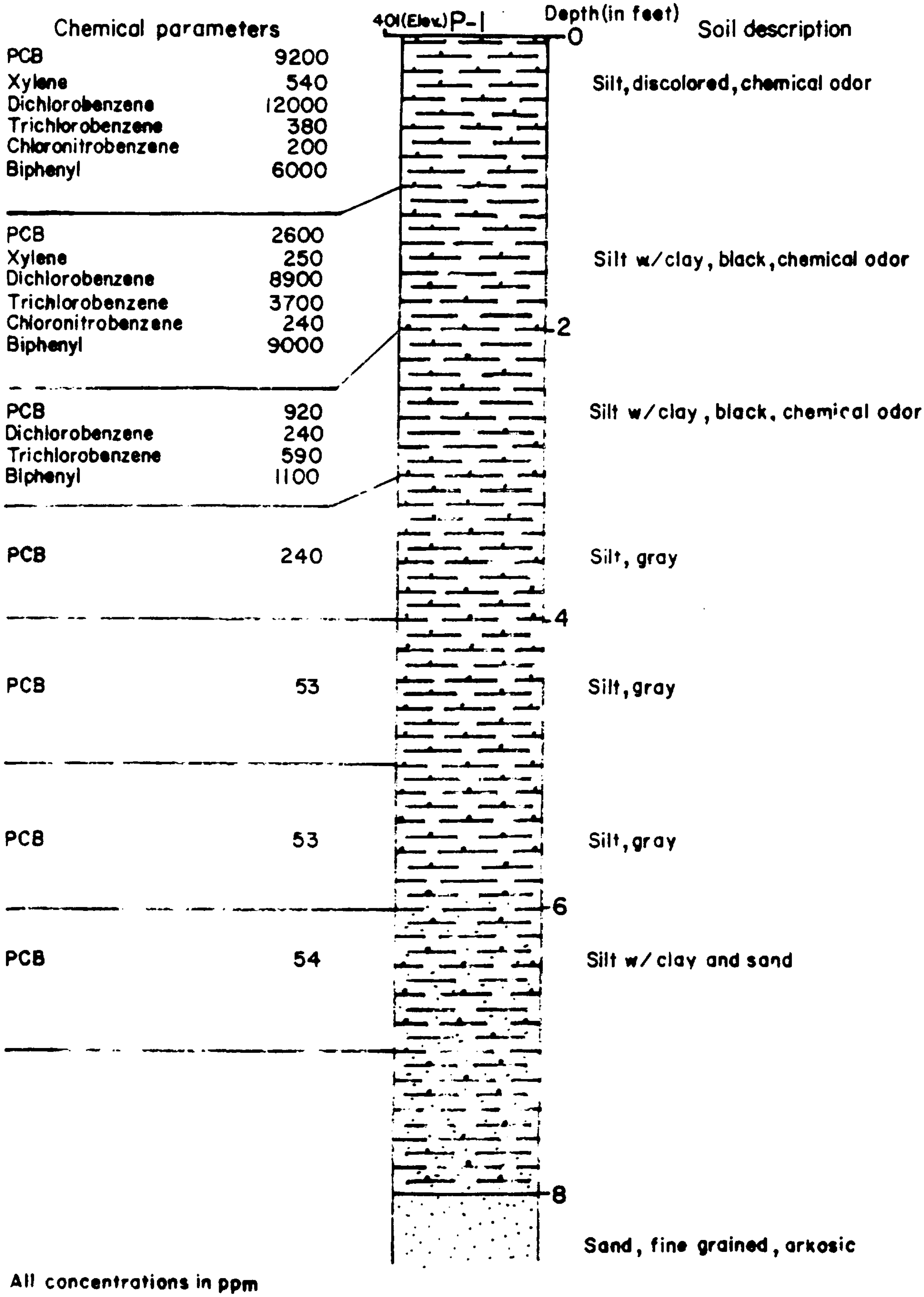
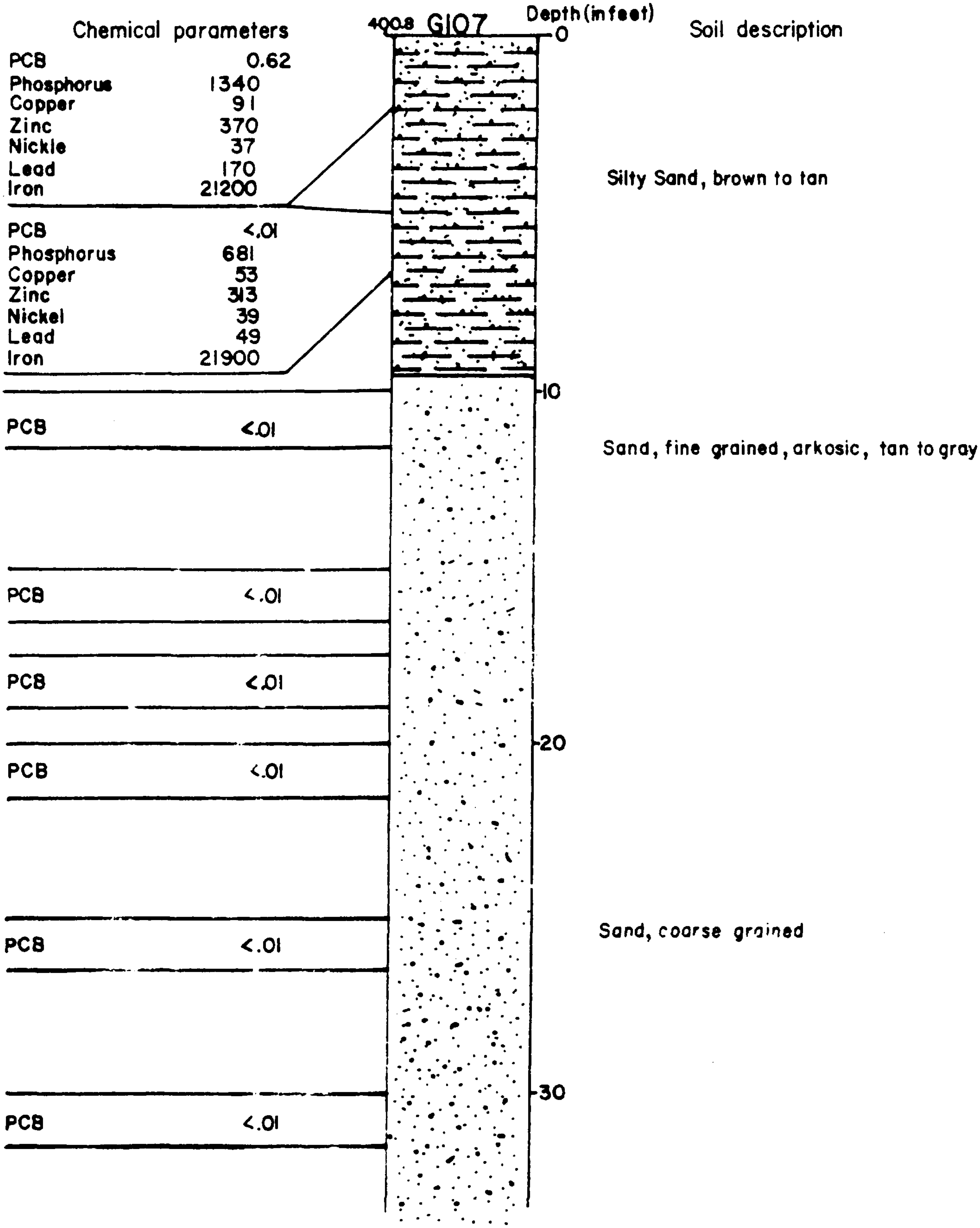
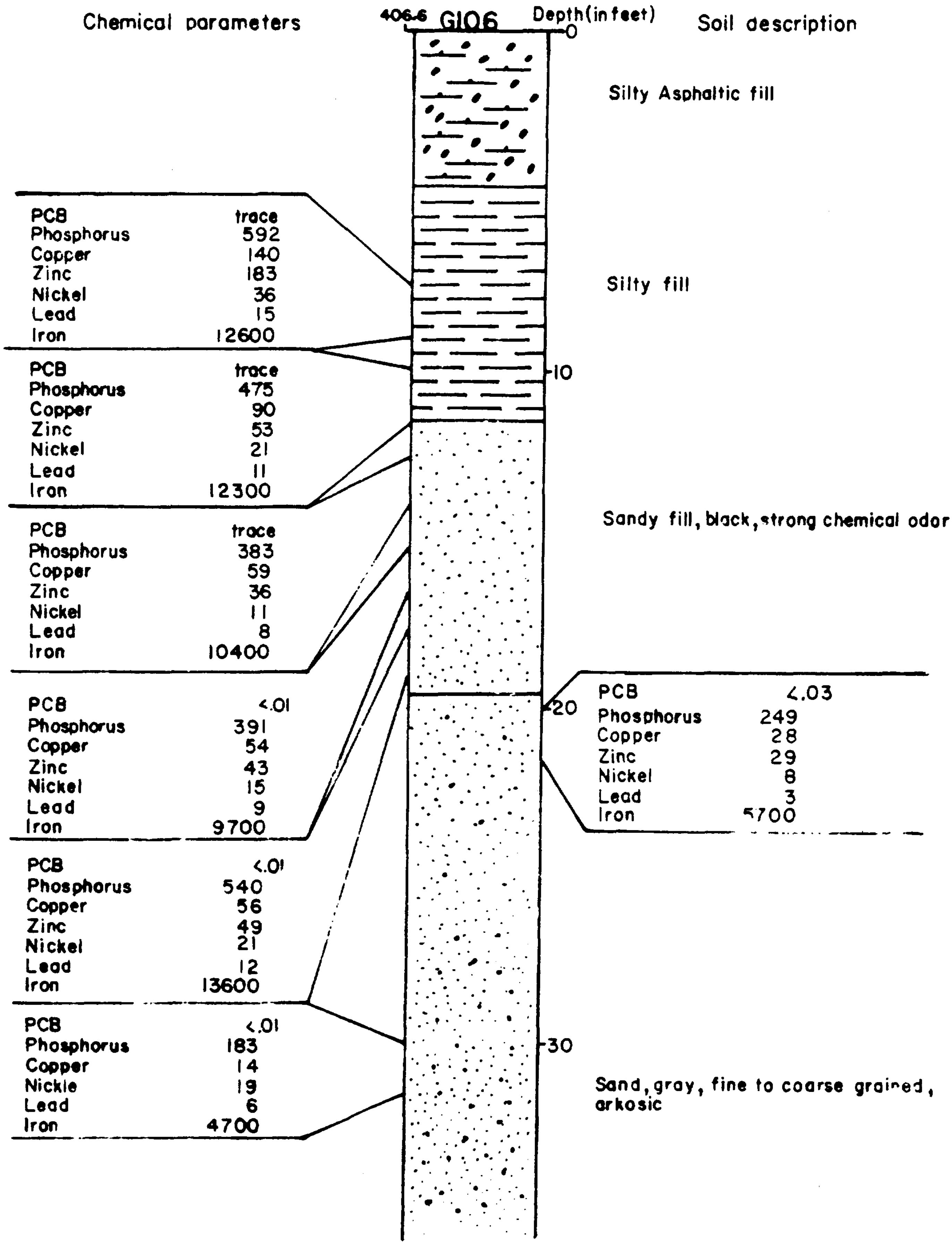


Figure 7a. Vertical distribution of organic chemicals in the creek bottom at P-1



All concentrations in ppm

Figure 7b. Vertical distribution of PCB's and metals at G107



All concentrations in ppm

Figure 7c. Vertical distribution of PCB's and metals at G106

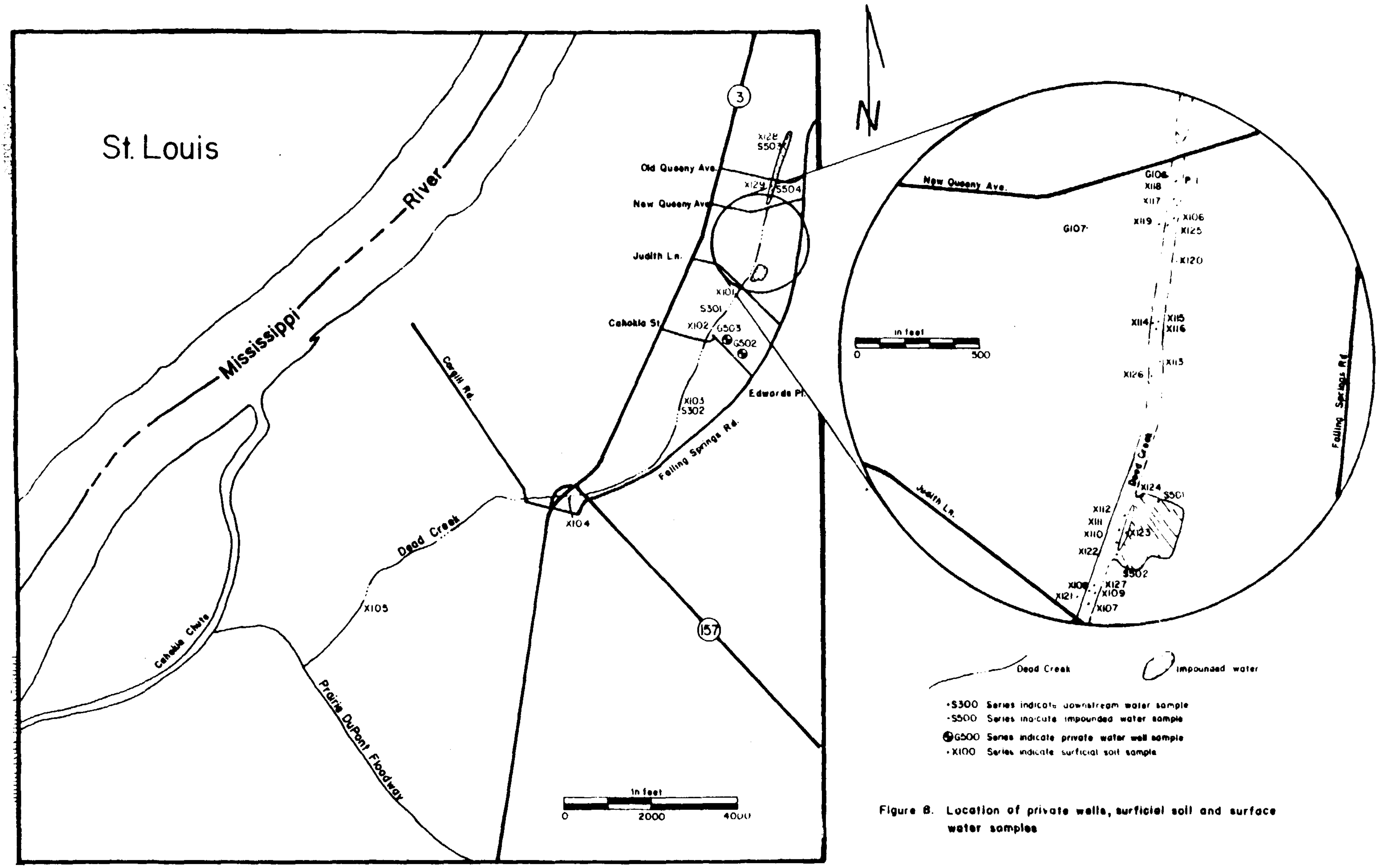


Figure 8. Location of private wells, surficial soil and surface water samples

nickel, sodium, strontium, and zinc. In fact, the highest concentrations of aluminum (12,000 ppm) and boron (76 ppm) are associated with these downstream soil samples. The relatively high concentrations in the downstream soil samples is due to transportation by the creek of the soils from upstream. It is noticed that at some locations concentrations are higher even though they are further downstream (X104 compared to X103). This can be attributed to dynamic properties of stream flow such as gradient, channel depth, and channel form. Besides the creek soils, unknown waste disposal activities at downstream locations might cause the high concentrations in soils. The only organic chemical to show up downstream was PCB, and it ranged from less than .05 ppm at X105 to 2.8 ppm at X103.

Soil samples taken in the creek bed between New Queeny Avenue and Judith Lane can be grouped into three areas (Figure 8), north, central, and south. Samples X106, X117, X118, X125, and the first sample of P-1 are surficial soil samples at the north end of the creek. When compared to the background sample X121, the analyses from the five samples above indicate that they contain very high levels of organic chemicals. The highest concentrations are PCB (10,000 ppm), dichlorobenzene (12,000 ppm), xylene (540 ppm), trichlorobenzene (380 ppm), chloronitrobenzene (200 ppm), biphenyl (6,000 ppm), dichlorophenol (170 ppm), alkylbenzenes (370 ppm), naphthalenes (650 ppm), and hydrocarbons (21,000 ppm). Although concentrations of these chemicals show drastic changes from one sample to another in the same area, it appears that sample P-1 has the highest concentration of organics. Most of the organics are not detected in samples X106 even though it is close to samples X125 and P-1. The difference is probably caused by both the creek bed topography, where an accumulation of organics has occurred in depressions and/or differences in permeability of the creek bed soils that might cause differential migration of organics downward from the soil surface. Inorganic chemicals are relatively high in comparison to the background sample in the northern part of the creek as well.

Five soil samples,X113, X114, X115, X116, and X126, were taken in the central portion of Dead Creek. Among these, only X126 was analyzed for organics and was found to contain only PCB (350 ppm). Analysis results indicate that this area contained very high levels of inorganics. The highest concentration for cadmium (400 ppm), cobalt (100 ppm), iron (365,000 ppm), mercury (30 ppm), sodium (2,800 ppm) are associated with X113. In addition, the highest concentration of zinc (71,000 ppm) was found at X115, chromate (400 ppm) at X114, and that of boron (76 ppm), copper (44,800 ppm) and phosphorus (8,900 ppm) at X126. In general, inorganic chemicals in this portion of the creek exceed background levels by several times.

Soil samples X107, X108, X109, X110, X111, X112, X122, X123, and X124 were taken in the southern part of the creek and near the pond. PCB was found in relatively high concentrations in X107 (120 ppm), X122 (540 ppm), X123 (1,100 ppm), X124 (24 ppm) and X127 (73 ppm). Also, 0.35 ppm and 23 ppm dichlorobenzene was found in X122 and X123, respectively. As for inorganics, the highest concentration of barium (8,000 ppm), lead (5,100 ppm), and strontium (430 ppm) are at X112, nickel (3,500 ppm) at X107, and that of vanadium (100 ppm) at X111. In general, the other inorganics are relatively high and above the background (X121) concentrations.

Vertical Distribution

Vertical distribution of chemicals in soils is examined in three locations, G106, G107, and P-1 (Figure 8), the results are presented in Figures 7a, 7b, and 7c.

Inorganic chemicals are analyzed in two locations, G106 and G107, to obtain data outside the creek bed itself. At G106, traces of PCB are shown in the upper three intervals. The metal concentrations show a general decrease with depth, however, analysis at G106 indicates that the metal concentrations of the upper silty fill and the sand immediately below are almost the same. At G107, only the two uppermost samples have been analyzed for metals, and although the data is incomplete, it seems metals and PCB increases with depth. Soils at G107 seem to contain a higher concentration of chemicals than those at G106. This would suggest waste disposal activity nearby. Presently, there is an open dump north of G107. This dump is bounded by the Weise Machinery building on the west, G107 on the south, New Queeny Avenue on the north, and G106 on the east.

Soil samples from P-1, located at the northern part of the creek bed, were analyzed for organics. The three surficial soil samples, to a depth of 3 feet, contain large amounts of PCB and organics. Below this interval, a decrease of organic chemicals is noted with depth, though there is a slight discrepancy with trichlorobenzene and chloronitrobenzene. Except PCB, other organics are not found below 3 feet in depth. Analyses indicate that most of the organics are confined to surficial soils and do not tend to travel vertically. This is probably due to both clay content of surficial soils, and the relatively low solubility of chlorinated hydrocarbons and their associated by products. PCB's show a slight vertical migration that probably reaches the Henry Formation sands and thus the ground water in minor amounts. Outside the creek bed very low amounts of PCB were found but other organics were not; inorganics appear to have traveled downward to some degree.

Ground Water

Aquifer

As stated previously, the Henry Formation sands are the major aquifer in the area. At the creek itself these valley train sands, on an average, rise to within 14 feet of surface. Figures 6a and 6b show the potentiometric level plotted at the site in cross section. It is seen by these cross sections that most of the ground water occurs in the Henry Formation sands. Exceptions occur in the northern and southern portions of the creek where the silt mantle thickens (Figure 6a, A-A') and the ground water level encounters it.

Water table as opposed to leaky artesian conditions (Bergstrom, 1956) prevail at the site because the lower portion of the alluvial silt is permeable enough (5.4×10^{-3}) not to impede vertical movement of the ground water.

The potentiometric surface map, Figure 9, indicates that the hydraulic gradient is very flat in the vicinity of Dead Creek. The gradient is 3'/1060' or .00283 generally moving to the west but with local fluctuations apparent. Periodic measurement of the potentiometric surface appear in Table 2. The following is a brief discussion of potential pollution sources and their impact on ground water.

Table 2. Ground water elevations in IEPA monitor wells, all elevations in feet above mean sea level

Well number	Measurement dates				
	10/22/80 10/23/80	10/30/80	10/31/80	1/28/81	2/18/81
G101	393.02	393.22	393.42	391.82	391.52
G102	394.29	394.49	394.09	392.79	392.69
G103	394.40		393.70	393.00	392.70
G104	393.60	393.70	393.40	390.60	392.00
G105	394.81	394.91	394.51	393.31	392.91
G106	394.17	394.17	394.87	392.57	392.77
G107	390.05	393.35	391.05	392.75	391.85
G108	395.06	395.26	394.16	394.26	393.96
G109	394.38	394.18	393.78	392.68	392.18
G110	394.74	394.64	394.34	393.44	393.04
G111		394.21	393.91	393.21	392.61
G112		394.32		392.32	392.22

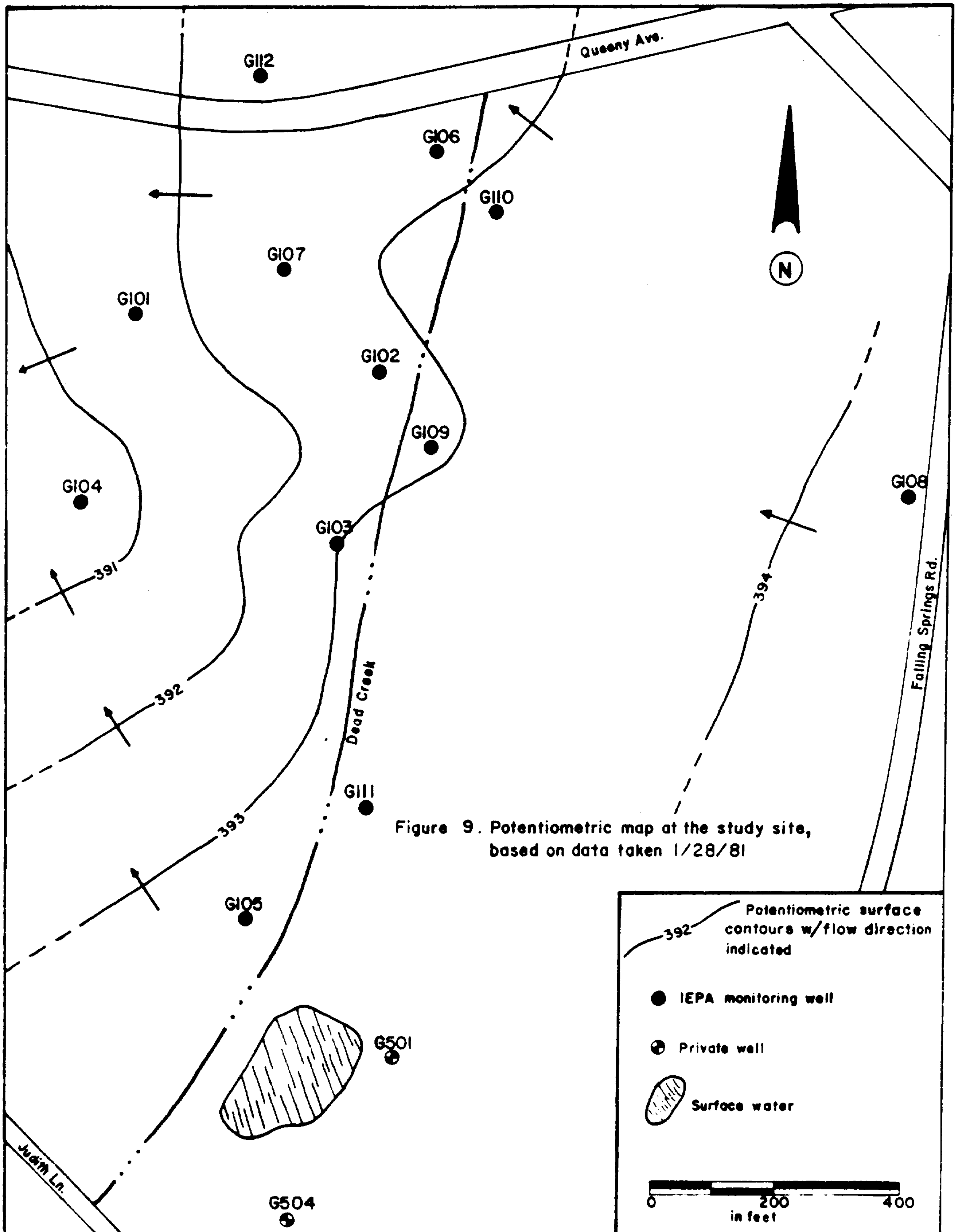


Figure 9. Potentiometric map at the study site, based on data taken 1/28/81

Dead Creek

Conditions in the creek are suspected of being a major contributor to ground water pollution. As seen in Figure 6b (cross sections C-B' and B-B'), the water table is just at the bottom of the creek fill material. This level is at its lowest point for the year though. Using information gathered from another site in the American Bottoms (East St. Louis/SCA-Milam), this level can be expected to rise approximately 3.65 feet at its peak level of the year. When this occurs, polluted fill material comes in contact with ground water. The ground water at this time produces a washing of these pollutants from the creek fill. Darcy's equation allows us to calculate the rate of flow beneath the creek in the sand aquifer and thus the rate at which these pollutants are washed away.

Darcy's equation: $Q = K \times \frac{dh}{dl} \times A$ where,

Q = flow rate
K = hydraulic conductivity (permeability)
$\frac{dh}{dl}$ = hydraulic gradient
A = cross section area through which water flows perpendicular to

At the creek the following conditions exist:

K = the average permeability of the aquifer is given to be 4.4×10^{-3}cm/sec or 4454 ft/year

$\frac{dh}{dl}$ = the hydraulic gradient is determined to be .00282

A = the area perpendicular to flow, using the 3.65 foot rise of the water table is 7210 square feet.

This data yields the following:

$$Q = K \times \frac{dh}{dl} \times A$$

$$Q = (4554 \text{ ft/year}) \times (.00283) \times (7210 \text{ ft}^2)$$

$$Q = 92{,}921 \text{ ft}^3\text{/year or } 1.32 \text{ gal/min}$$

At the same time an approximation of velocity, V, can be calculated for the water in the aquifer. This is the velocity at which the pollutants contributed by the creek move away from it. Here,

$$V = K \times \frac{dh}{dl} \times \frac{1}{N} \text{ where}$$

V = velocity and N = effective porosity.

It is assumed that the effective porosity of the Henry Formation sands is 0.20 (Walton, 1970) which gives the following:

$$V = (4554 \text{ ft/year}) \times (.00283) \times \frac{1}{0.20} = 64.4 \text{ ft/year or } 0.18 \text{ ft/day}$$

The period of time required for surface water to infiltrate the bottom of the creek and travel through the fill to ground water can be calculated from:

$T = \frac{L}{V}$ where,

T = time required
L = distance traveled (thickness of layer)
V = velocity

The velocity of water movement through the fill can be calculated by the equation used previously. If it is assumed that the fill material with a permeability of 1.0×10^{-6} has an effective porosity of .10 and thickness of 8 feet under unit hydraulic gradient, this yields:

$$V = K \times \frac{dh}{dl} \times \frac{1}{N} \text{ and}$$

$$V = (1.03 \text{ ft/year}) \times (\frac{8 \text{ ft}}{8 \text{ ft}}) \times \frac{1}{.10} = 10.30 \text{ ft/year or } .0282 \text{ ft/day}$$

The time required for movement of water through the fill can now be calculated in the northern part of the creek where the fill is 8 feet thick as,

$$T = \frac{L}{V}$$

$$T = \frac{8 \text{ feet}}{10.30 \text{ ft/year}} = .777 \text{ years or } 284.0 \text{ days}$$

and at the south end of the creek where the fill material thickens to 10 feet as,

$$T = \frac{L}{V}$$

$$T = \frac{10}{10.30 \text{ ft/yr}} = .9708 \text{ years of } 354.0 \text{ days}$$

This means that if the fill in the creek is saturated and there is only a film of liquid in the creek, that it will take between 284 to 354 days to reach the ground water. However, if large amounts of liquid wastes are disposed of in the creek or much water exists in the creek after a rain, vertical migration is probably much more rapid.

Due to complexities involving surrounding surface runoff and infiltration percentage of precipitation, the flow rate through this layer cannot be calculated.

Holding ponds at Cerro Copper

Prior to blocking the culvert at New Queeny Avenue the impounded waters on Cerro Copper were once the head waters for Dead Creek. Because of this, it is assumed that the morphology is similar and that the time required for the impounded water to infiltrate through the creek fill is much less than that calculated for the northern portion of the creek, 284 days. This is because the impounded water results in a larger head and increases the velocity of the ground water movement. Becker (1975) identified four outfalls entering this pond from the Cerro Copper plant.

The Disposal Impoundment

As seen in a 1973 map by the U.S.A.C.E. (St.Louis District), the area of the disposal impoundment is approximately 20,000 square feet. The wastes dumped into it and the later leaching by rain water are then sources of potential ground water pollution here.

Mr. Waggoner stated in 1971 that he used approximately 100 gallons of water per day to wash out his trucks that carried industrial waste. This is most likely a conservative estimate. He operated in this manner from August, 1971 until sometime in 1974, when he sold the company to Ruan Trucking Company, who continued the same practice until 1978. If it's assumed that they "washed their trucks out" 5 days a week during this period of time, the following estimate as to the amount of disposal can be made:

(100 gal/day) x (6.3 years) x (52 weeks/year) x (5 days/week) = 163,800 gallons

It is felt that this excavation caused large amounts of ground water pollution, as seen from the above value, and from the drilling of monitor well G109 (Figure 4). While drilling it, the driller and his assistant operating the rig became nauseous from the fumes. These conditions were due to its location in a small strip of virgin soil between the creek and the disposal impoundment. Since the soils above the water table are relatively clean until encountering the ground water, and no mounding is shown at this well location, it must be assumed that the disposed liquids migrated vertically from the impoundment. Upon encountering the ground water table, pollutants traveled in the direction of ground water flow (to the west), and reached well G109.

The Pond Occupying H. H. Hall Construction's Sand Pit

The water level in this pond is 1.5 to 2.0 feet higher than the closest wells to it (G111, G105), therefore, it is assumed that the water in the pond has no hydrological connection to the ground water aquifer. Since this pit was excavated to obtain the Henry Formation sands, it at one time must have extended down to the aquifer. The only explanation for this breech then, is that the pond has silted in to the point where the water in the pond is of a perched nature. This silting action occurred in the same way as that previously described for the creek bottom. Evidence for the deposition of this silt fill in recent times occurs at the Judith Lane culvert. This culvert (with a diamter of 6 feet) was installed in the early 1950's to allow for better creek flow under the road. Subsequent sedimentation in the creek has filled to within one foot of the top of this culvert. This means that the water level in the pond fluctuates independently of the ground water aquifer.

Water Quality

Ground Water

The monitoring wells installed by the IEPA have been sampled twice during this study. The location of these wells are shown on Figure 4, and analysis results are presented in Tables 4a and 4b. In addition to these wells, four private wells (Figures 4 and 8) have been sampled to establish the background quality. Water samples were collected and preserved according to the Agency standards, however, the samples were not filtered. Analysis for the background is in

Table 3. Ground water quality in private wells (background), concentrations in ppm except where noted

Parameters	Ground water standards	Collection date and well number			
		9/16/80 G501	9/16/80 G502	9/16/80 G503	9/23/80 G504
Arsenic	0.05	0.008	0.004	0.001	<0.001
Barium	1.0	0.2	0.16	0.39	0.05
Boron	1.0	0.28	0.27	0.25	0.58
Cadmium	0.01	<0.001	<0.005	<0.002	<0.002
Chromium	1.05	<0.01	<0.005	<0.01	NA
Copper	0.02	0.02	<0.005	<0.005	0.06
Iron	1.0	4.6	19.0	17.7	0.73
Lead	0.05	<0.02	<0.02	<0.05	<0.04
Magnesium	NE	33.0	39.0	36.0	30.0
Manganese	0.15	1.02	1.26	0.79	0.65
Mercury	0.0005	<0.0001	<0.0001	<0.0001	0.0001
Nickel	1.0	<0.005	<0.0005	<0.01	0.02
Phosphorus	0.05	<1.0	<1.0	<1.0	0.2
Potassium	NE	6.6	5.7	4.5	6.0
Silver	0.0005	<0.005	<0.005	<0.005	<0.01
Sodium	NE	21.0	24.0	12.0	26.0
Zinc	1.0	0.85	NA	0.18	0.8
PCB (ppb)	NE	NA	NA	NA	<0.1

NE - Not established
NA - Not attempted

Table 4a. Analysis of ground water samples from the IEPA monitoring wells on 10/23/80 in ppm except when noted

PARAMETERS	STANDARDS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	NE	36[illegible]	41[illegible]	336	406	271	36[illegible]	552	37[illegible]	257	21[illegible]	302	699
Ammonia	1.5	0.3	1.6	1.7	0.4	0.9	2.9	0.5	0.3	4.5	1.2	0.1	1.5
Arsenic	.05	.023	.023	.043	.049	.067	.16	.043	.008	.055	.053	.008	.019
Barium	1.0	1.3	0.8	2.9	2.2	2.0	0.6	2.1	0.3	0.2	0.5	0.2	0.5
Boron	1.0	0.5	0.4	0.5	0.6	0.4	0.5	0.5	0.4	0.4	0.5	0.5	5.6
Cadmium	.01	0.0	0.0	.03	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	.06
Calcium	NE	180	210	210	210	340	185	500	140	380	500	110	242
C.O.D.	NE	237	160	244	206	473	115	1070	298	2[illegible]5	780	79	162
Chloride	250	48	103	56	52	65	105	13[illegible]	79	69	61	32	363
Chromium (total)	1.05	.04	.02	.09	.04	.12	.01	.07	0.0	0.0	.38	0.0	.01
Chromium (+6)	.05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Copper	.02	.46	.13	1.1	.31	.73	.44	.68	.04	.13	2.3	.04	1.2
Cyanide	.025	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0
Fluoride	1.4	0.4	0.7	0.7	0.3	1.0	0.7	0.7	0.3	1.2	0.8	0.3	0.5
Hardness	NE	501	884	549	630	528	637	777	496	1664	279	419	1080
Iron	1.0	51.0	39.5	86	89	18	62	13	4.1	39.0	340	5	18
Lead	.05	.19	.15	0.26	0.2	0.31	0.0	0.27	0.0	0.0	7.3	0.07	0.44
Magnesium	NE	69	90	79	72	100	49	205	24	100	209	24	82.5
Manganese	.15	5.1	3.8	4.2	3.4	4.2	1.9	9.8	0.98	4.5	8.8	1.1	3.9
Mercury	.0008	0.0	0.0	.0002	0.0	0.0	0.0	0.0	.0001	0.0	0.0	0.0	.0001
Nickle	1.0	0.1	0.1	0.9	0.1	0.8	0.1	0.3	0.0	0.5	1.9	0.0	0.3
Nitrate-nitrite	10.0	0.1	0.1	0.1	0.4	0.0	0.1	0.1	1.1	0.0	0.4	0.5	0.0
pH	6.5-9.0	6.6	6.6	6.5	6.6	6.6	6.5	6.4	6.6	6.3	6.7	7.0	6.4
Phenolics	.001	0.0	.01	0.0	.005	0.0	.065	2.5	.01	.45	.015	0.0	.875
Phosphorus	.05	2.9	1.2	3.3	2.7	6.0	1.8	9.4	.18	.72	16	.24	.69
Potassium	NE	10.6	13.1	13.4	12.3	22	7.7	15.2	13.7	14.9	29	4.9	58
R.O.E.	500	650	1230	765	790	824	1020	1230	704	2460	508	512	2190
Selenium	.01	.003	.001	.004	.01	.008	.001	.004	.001	.001	.005	.002	.001
Silver	.005	.0[illegible]	0.0	.02	0.0	0.0	0.0	0.0	.01	0.0	0.0	.02	.11
Sodium	NE	24	60	40	29	57	96	NA	40	40	53	24	260
S.C.	NE	870	1560	1050	1080	1040	1340	1430	960	2470	720	490	NA
Sulfate	250	132	434	230	204	296	281	201	103	1348	93	104	518
Zinc	1.0	0.6	0.4	6.2	0.3	3.7	0.1	0.8	0.0	0.1	9.0	0.0	7.8
PCB (ppb)	NE	1.0	1.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	2.7	< 0.1	< 0.1
Chlorophenol (ppb)	NE	BDL	1200	BDL	BDL	BDL	BDL	630	BDL	19	BDL	BDL	BDL
Chlorobenzene (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	19	BDL	BDL	BDL	BDL	100
Dichlorobenzene (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	25	BDL	BDL	BDL	BDL	65
Dichlorophenol (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	890	BDL	BDL	BDL	BDL	BDL
Cyclohexanone (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	120	5.9	BDL	BDL
Chloroaniline (ppb)	NE	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	3500

Red indicates above standard amouts NA = Not Attempted NE = Not Established BDL = Below Detection Limit

Table 4b. Analysis of ground water samples from the IEPA monitoring wells on 1/28/81 in ppm except when noted

PARAMETERS	STANDARDS	G101	G102	G103	G104	G105	G106	G107	G108	G109	G110	G111	G112
Alkalinity	NE	447	421	266	520	363	556	621	448	18	308	394	619
Ammonia	1.5	0.3	0.0	1.4	0.2	0.7	3.3	1.0	0.0	17	0.2	0.1	0.5
Arsenic	0.05	0.015	0.016	0.018	0.002	0.037	0.11	0.021	0.004	7.5	0.013	0.014	0.027
Barium	1.0	0.9	1.2	0.9	0.3	1.8	1.0	3.2	0.5	0.2	1.0	0.7	0.5
Boron	1.0	0.3	0.4	0.4	0.7	0.4	0.5	0.5	0.2	0.8	0.2	0.6	0.9
Cadmium	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00
Calcium	NE	220.0	328.9	176.3	218.0	319.2	225.5	1169.5	205.5	466.7	169.4	181.4	198.3
C.O.D.	NE	45	93	56	9	143	212	635	8	1315	37	28	47
Chloride	250	20	128	64	29	59	156	201	76	32	36	18	210
Chromium (total)	1.05	0.02	0.02	0.02	0.00	0.03	0.00	0.09	0.00	0.04	0.02	0.02	0.00
Chromium (+6)	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	0.02	0.59	0.79	0.36	0.14	0.43	0.29	0.97	0.00	94.1	0.11	0.04	0.28
Cyanide	0.025	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Fluoride	1.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Hardness	NE	554	1072	490	717	764	617	960	564	2144	447	530	486
Iron	1.0	30.4	16.5	20.8	1.4	60.8	67.5	172	0.3	198	19.1	10.7	18.9
Lead	0.05	0.17	0.08	0.00	0.00	0.07	0.00	0.32	0.00	0.00	0.00	0.00	0.00
Magnesium	NE	48.2	78.0	46.3	49.1	73.6	49.1	288.1	34.3	184.4	43.5	37.9	54.0
Manganese	0.15	3.02	3.15	3.07	1.41	4.10	2.13	9.64	0.34	8.30	0.77	1.76	2.78
Mercury	.0005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0004	0.0	0.0	0.0
Nichel	1.0	0.1	0.1	0.4	0.0	0.2	0.0	0.5	0.0	176	0.9	0.0	0.0
Nitrate – nitrite	10.0	0.0	2.5	0.1	0.5	0.0	0.0	0.2	3.5	0.3	18	0.5	0.0
pH	6.5 – 9.0	7.0	7.0	7.1	7.2	7.0	6.9	6.9	7.1	4.1	6.9	7.0	6.9
Phenolics	.001	0.0	0.0	0.0	0.0	0.0	1.46	0.5	0.01	1.86	0.02	0.015	0.05
Phosphorous	0.05	0.91	0.88	0.41	0.06	3.6	2.1	10	0.03	3.7	1.0	0.51	0.53
Potassium	NE	6.4	12	8.8	6.0	13	6.2	20	16	18	7.5	4.2	20
R.O.E.	500	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	0.01	0.002	0.002	0.002	0.002	0.003	0.002	0.011	0.004	0.006	0.016	0.002	0.0
Silver	.005	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sodium	NE	13	63	48	15	50	94	60	30	37	13	14	18
S.C.	NE	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate	250	129	583	256	265	468	143	276	86	3371	57	153	212
Zinc	1.0	0.3	1.2	1.8	0.1	1.5	0.1	1.5	0.0	10.1	2.0	0.1	2.8
PCB (ppb)	NE	0.22	3.9	NA	0.3	BDL	NA	0.4	BDL	NA	NA	NA	BDL
Chlorobenzene (ppb)	NE	NA	NA	NA	NA	NA	NA	63	BDL	BDL	NA	NA	25
Dichlorophenol (ppb)	NE	NA	NA	NA	NA	NA	NA	560	BDL	BDL	NA	NA	BDL
Chloroaniline (ppb)	NE	NA	NA	NA	NA	NA	NA	90	BDL	BDL	NA	NA	21

Red indicates above standard amounts

NA= Not Attempted NE=Not Established BDL= Below Detection Level

Table 3. Because the ground water flow direction is generally east to west, G108 can also be considered a background well. A comparison of the analysis for G108 (Table 4b) with that of G501, G502, G503, and G504 (Table 3) indicates that it indeed is of background quality.

Inorganic chemical parameters analyzed for background quality indicate that iron, manganese, and phosphorus are generally above the State's water quality standards. Organic analysis of these wells showed nothing above the detection limit of 0.1 ppb (Tables 3 and 4b).

In general, results from Table 4a are lower than those found in Table 4b. This is probably due to dilution of samples, which occurred when samples of 4a were collected too soon after drilling and washing of the wells.

Data in Tables 4a and 4b indicates that concentrations of copper, iron, manganese, phosphorus, and R.O.E. exceed the standards and background quality in every well. Lead, phenolics, sulfate and zinc are above the standards in six or more wells.

Among organics analyzed, PCB's were detected in wells G101, G102, and G110. Compared to other wells the relatively high concentrations of 2.7 ppb and 3.9 ppb were found in G110 and G102. Other organics detected such as chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, cyclohexanone, and chloroaniline were mostly associated with G107 and G112 even though some other organics were also found in G102, G109, and G110. All these organics are relatively high and not found in the background wells. The organic and inorganic analysis discussed above demonstrate ground water pollution in the area from various sources.

Among the wells, it appears that the ground water in G109 is the most polluted. At G109, ammonia, arsenic, cadmium, copper, iron, manganese, nickel, pH, phenols, phosphorus, R.O.E., sulfate, and zinc exceed the water quality standards by several times. Other parameters for which no standard exists are also in high concentrations. This well is located between Dead Creek and the former disposal impoundment, the exaggerated quantities of ammonia, arsenic, cadmium, copper, nickel, and sulfate must be attributed to this excavation because quantities in other wells directly adjacent to the creek are at least 10 fold less.

Two other wells G112 and G107 exhibit concentrations much above the State Water Quality Standards. One or the other, or both, of the wells show concentrations of barium, boron, copper, iron, lead, manganese, phenols, phosphorus, selenium, sulfate, and zinc above standards. They are also the wells in which organics were detected the strongest. In G107 the two samplings have shown that chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, and chloroaniline are present. In G112 chlorobenzene, dichlorobenzene, and chloroaniline have been detected. Since these two wells have these similar characteristics it must be assumed that the pollution source must be common as well. The pollution source is most likely the open dump discussed previously, which lies between the two wells.

Among other highly polluted wells are G110, G106, G105, G103, and G102. Several inorganic parameters are much above the background quality and the standards. Also, some PCB was found in G101 and G102. In G102 chlorophenol was found, and might be explained by its location near the dump which has been suspected of supplying this parameter to wells G107 and G112. Another well, G110, is located between Dead Creek and the believed locations of former sand pits (Figure 4). The only above standard concentration of nitrate (18 ppm) and the

Table 5. Analysis of surface water samples, in ppm except where noted

Parameters	Water quality standards	Collection date and well number					
		9/15/80	9/15/80	11/26/80	11/26/80	9/25/80	9/25/80
		S501	S502	S503	S504	S301	S302
Alkalinity	NE	80.0	85.0	NA	NA	NA	NA
Ammonia	1.5	0.0	0.0	NA	NA	NA	NA
Arsenic	1.0	0.006	0.01	0.058	0.025	0.008	0.006
Barium	5.0	0.2	0.5	1.2	0.7	0.12	0.08
Berylium	NE	NA	NA	NA	NA	<0.001	<0.001
BOD-5	NE	4.0	33.0	NA	NA	NA	NA
Boron	1.0	0.2	0.2	0.20	0.3	0.06	0.04
Cadmium	0.05	<0.002	<0.002	0.36	0.19	<0.005	<0.005
COD	NE	58.0	85.0	NA	NA	NA	NA
Chloride	500	27.0	28.0	NA	NA	NA	NA
Chromium (total)	1.05	<0.005	<0.005	0.61	0.21	<0.01	0.01
Chromium (+6)	0.05	0.0	0.0	NA	NA	NA	NA
Copper	0.02	0.035	0.33	4.5	3.6	0.26	0.04
Cyanide	0.025	0.02	0.0	NA	NA	NA	NA
Fluoride	1.4	0.4	0.4	NA	NA	NA	NA
Hardness	NE	84.0	94.0	NA	NA	NA	NA
Iron	1.0	0.8	1.8	58.0	28.0	0.66	0.87
Lead	0.1	0.0	0.01	6.6	2.8	<0.05	<0.05
Magnesium	NE	6.0	6.0	35.8	28.7	3.0	2.0
Manganese	1.0	0.06	0.82	1.0	0.67	0.03	0.12
Mercury	0.0005	0.0000	0.0	0.0016	0.0016	NA	NA
Nickel	1.0	0.02	0.05	4.2	3.3	0.05	0.01
Nitrate-Nitrite	NE	0.0	0.0	NA	NA	NA	NA
pH	6.5-9.0	7.4	7.0	NA	NA	NA	NA
Phenols	0.1	0.01	0.01	NA	NA	NA	NA
Phosphorus	0.05	0.17	0.31	1.9	3.4	0.19	0.2
Potassium	NE	5.9	6.2	4.3	6.2	6.6	3.3
R.O.E.	1000	201	217	NA	NA	NA	NA
Selenium	1.0	NA	NA	NA	NA	NA	NA
Silver	0.005	<0.005	<0.005	0.24	0.14	<0.01	<0.01
Sodium	NE	24.0	25.0	19.7	22.4	3.0	3.0
Strontium	NE	NA	NA	NA	NA	0.08	0.07
Sulfate	NE	30.0	28.0	NA	NA	NA	NA
Vanadium	NE	NA	NA	NA	NA	<0.005	<0.005
Zinc	1.0	0.1	0.7	30.0	17.0	0.24	0.06
PCB (ppb)	NE	0.9	4.4	22.0	28.0	1.0	<0.1
Aliphatic hydrocarbons (ppb)	NE	BDL	BDL	23,000	BDL	BDL	BDL

NE - Not established
NA - Not attempted
BDL - Below detection limit

	PCB level (in ppm)
Beans	0.06
Bean leaves	0.13
Corn	0.05
Okra	0.05

Although the Food and Drug Administration has assigned no action level for PCB's in plant matter, it is felt that these values are minute, and do not present any hazard to public health.

RStJ:tk

Summary, Conclusions, and Recommendations

This report is prepared to determine the hydrological framework and possible disposal sites in that part of Dead Creek which lies between New Queeny Avenue and Judith Lane. The potential disposal sites in the area, which have had an impact on ground water, soils, and plants, include: an open dump, a holding pond at Cerro Copper, a former disposal impoundment on the east side of the creek, a pond which exists in H. H. Hall's former sand pit, and 3 sand pits which are now filled.

Twelve monitoring wells drilled adjacent to Dead Creek, and 5 hand auger borings made in the creek, indicate that a 6 to 17 feet thick silt mantle overlies the Henry Formation sands, which are the major aquifer in the area. The creek, which has fill material in it now, at one time had scoured down into the Henry Formation sands. It is clear that soils and ground water in the immediate vicinity of Dead Creek are polluted and that further study is needed for more definitive answers. The ground water quality in the IEPA monitoring wells is probably a result of the above pollution sources combined. These wells show that ground water in the vicinity of the creek has been effected most, and that downgradient wells, some 400 feet away, show little contamination.

The findings and conclusions reached, based on this study, are listed below:

1) The surficial silt mantle is thin and has an average permeability of 5×10^{-6} cm/sec.

2) The Henry Formation sands are a major aquifer and have an average permeability of 4.4×10^{-3} cm/sec.

3) At one time the creek bottom reached, and the sand pits were excavated into the Henry Formation sands.

4) Chemical analysis of soils indicate that surficial soils are primarily polluted at the holding pond in Cerro Copper's plant and in Dead Creek itself.

5) Soil samples from the pond are high in inorganics and organics, including silver, nickel, lead, cadmium, arsenic, copper, manganese, PCB, aliphatic hydrocarbons, and dichlorobenzene.

6) Soil samples from the creek in the study area were high in organics and inorganics. In general, organics were high in the north end, and inorganics in the south end. PCB, dichlorobenzene, xylene, trichlorobenzene, chloronitrobenzene, biphenyl, dichlorophenol, alkylbenzenes, naphthalenes, hydrocarbons, cadmium, cobalt, iron, mercury, zinc, chromate, copper, and phosphorus were in high concentrations. Waste disposal in the creek is the main cause of higher levels of chemicals.

7) PCB and inorganics have migrated to some degree vertically into the Henry Formation sands from the creek bed.

8) When traveling westward, ground water carries away pollutants from the fill in the creek.

9) Surface water from the creek infiltrates downward and carries pollutants into ground water.

10) The holding ponds on Cerro Copper's property, the disposal impoundment, and the open dump are among the major pollution sources of ground water in the area.

11) There has been no tangible evidence to show that former sand pits in the area contribute to any ground water pollution. This does not mean that they don't.

12) Ground water near the creek is polluted. The pollutants include PCB, chlorophenol, chlorobenzene, dichlorobenzene, dichlorophenol, cyclohexanone, chloroaniline, copper, iron, manganese, phosphorus, and R.O.E.

13) Ground water pollution is somewhat reduced at monitoring wells located approximately 400 feet west of the creek.

14) Water from the pond in the Cerro Copper Plant is highly polluted with organics and inorganics.

15) With the present data available, it is difficult to determine the effect which the pond by Judith Lane has on the areas ground water.

Recommendations

1) Ground water pollution sources are many in the area, and further detailed study(ies) is necessary to determine their location, extent and impact on the ground water.

2) Ground water in the study area should not be used for human consumption.

3) Feasibility of removing all wastes and polluted soils from the former disposal impoundment, Cerro Copper's ponds, and the open dump should be studied. If not possible, these areas should have suitable cover material and monitor wells placed on them.

4) The fill material in the creek should be removed and the creek must be filled with a clayey soil later. If this is not possible, the present creek topography must be filled to the ground level with a clayey soil.

5) Taking the above recommendations into consideration, a plan might also be developed to install a system of monitor wells for ground water quality analysis in the area. This could aid local well drillers and public officials to insure public safety.

6) Plans for the construction of New Queeny Avenue should be secured to determine the depth of former sand pits in the area.

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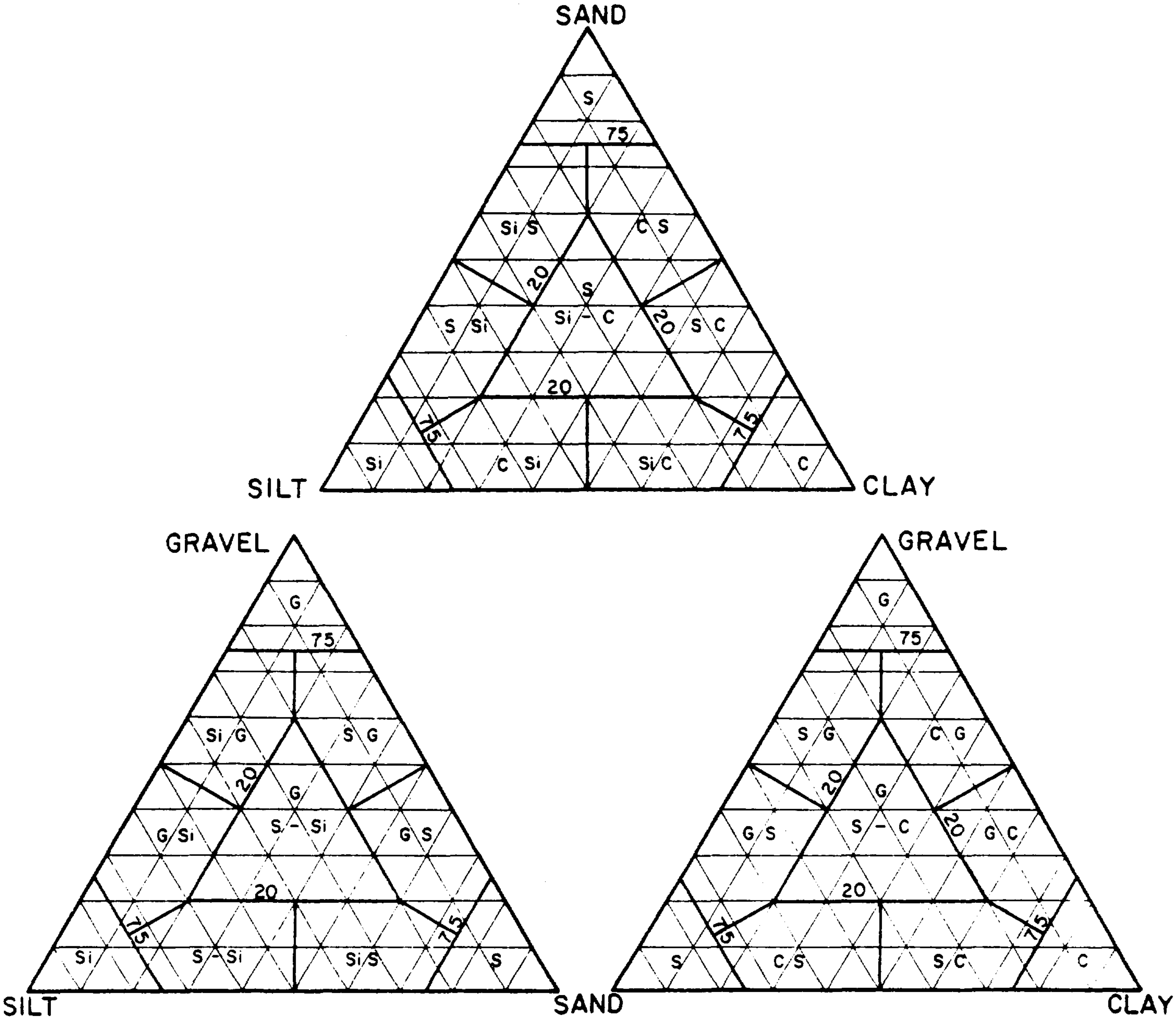
Appendix 1 - Boring Logs



Percent grain size	Adjective modifiers for minor grain sizes*
not included in major classification	w/ some
< 5 %	trace

*Only applicable to wells bored by the IEPA

Figure A-1. Textural triangles (adopted from Shepard, 1954) and terminology used for classification of unconsolidated deposits.

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH 1 of 1 SH.

COUNTY St. Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/8/80 BORING NO B-1 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ____ WHICH Monitor (G-101)

TYPE AND LENGTH OF CASING PVC 29.5 FT CASING 1.0 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 371.32 to 391.32 (20 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cutting
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 390.32
AFTER 2 DAYS 393.92
AFTER 14 DAYS 393.22

Description	Elevation	Depth	#	•	N
		+3			
GROUND SURFACE	399.82	0			
Clayey Silt (topsoil) dark brown to gray			1	M	
organics				D	
		5	2	M	
	392.15				
Silt Brown micaceous			3	W	
	389.82	10			
Sand (arenitic) Tan very fine grained, moderately sorted, rounded, containing ferro-magnesian minerals.			4	W	
			5	W	
	384.82	15			
Sand (arkosic) Tan fine to coarse grained, moderately rounded, containing ferro-magnesian minerals				W	
		20			
very poorly sorted			6	W	
		25			
w/some rounded medium grained gravel			7	W	
		30			
	367.82			W	
Boring completed					

Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

Miscellaneous Data PR - Partial Recovery
Blow Count NR - No Recovery

47

LPC-34 3/79

St. Clair County
Dead Creek/Cahokia
B-2 (G-102)

	ELEVATION	*	•	N	WELL DESIGN
	-35				
Sand (arkosic) Gray fine to medium grained, poorly sorted, contains coal & wood chips throughout 371.89			NR	17/14	
Boring completed	-40				
	-45				
	-50				
	-55				
	-60				

	ELEVATION	*	•	N	WELL DESIGN
	-65				
	-70				
	-75				
	-80				
	-85				
	-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG

COUNTY St.Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/9/80 BORING NO. B-3 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-103)

TYPE AND LENGTH OF CASING PVC 35.5 FT CASING 2.7 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 375.30 to 401.90 (26.6 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cuttings
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 393.10
AFTER 1 DAYS 394.1
AFTER 13 DAYS 394.4

Description	Elevation	*	•	N
	+3			
GROUND SURFACE 408.10	0			
Clayey Silt (topsoil) Brown w/some sand		1	D	
Silt Light tan micaceous			D	4/4
Clayey Silt w/some sand oxidation	-5	2	D	5/4
Sandy Silt Tan to gray w/some clay micaceous throughout		3	D	2/2
Clayey Silt Gray 396.85	-10	4	M	2/2
Sand (arkosic) Tan very fine grained		5	W	4/5
	-15			

Description	Elevation	*	•	N
Sand (arkosic) w/some silt Tan fine grained		6	W	5/7
	-20			
w/some silt		7	W	6/9
	-25			
fine to medium grained, moderately sorted, subrounded		8	W	5/7
	-30			
w/some gravel fine to coarse grained, poorly sorted w/black petroleum smelling substance		9/10	W	9/17

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery
N - Blow Count NR - No Recovery

LPC-34 3/79

St. Clair Dead Creek/Cahokia B-3 (G-103)	ELEVATION			N	WELL DESIGN
Sand (arkosic) Tan medium to coarse grained, poorly sorted, subangular w/wood chips & peculiar smell	-35	11	W	8/15	
371.60					
Boring complete	-40				
	-45				
	-50				
	-55				
	-60				

ELEVATION			N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Ken Bosie

DATE 10/9/80 BORING NO. B-4 HELPER Ron St. John

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-104)

TYPE AND LENGTH OF CASING PVC 37.4 FT CASING 3.4 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 375.3 to 400.3 (25 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cuttings
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 392.80
AFTER 1 DAYS 393.4
AFTER 14 DAYS 393.6

Description	Elevation	*	•	N
	+3			
GROUND SURFACE 409.30	0			
Silty Sand (topsoil) Light tan w/some clay throughout		1	D	
Sandy Silt micaceous		2	D	3/5
2" clay lense 402.30	-5	3	M	4/5
Silty Sand Light tan micaceous Brown & gray 397.30		4	M	4/5
Sand (arkosic) Tan fine to medium grained 394.80	-10	5	M	5/4
Clay Gray oxidation	-15	6	W	5/4
Clay Gray oxidation 392.80		7	W	2/6
Sand (arkosic) Tan to brown fine to medium grained		8	W	8/8
	-20		W	3/5
	-25	9	W	5/8
fine to coarse grained, poorly sorted, subrounded w/gravel	-30	10	W	8/9

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery

52

BORING LOG

St. Clair County
Dead Creek/Cahokia
B-4 (G-104)

	ELEVATION	#	•	N	WELL DESIGN
Sand Tan & brown fine to coarse grained, poorly sorted, subrounded w/occasional gravel 372.80	-35				
Boring complete	-40				
	-45				
	-50				
	-55				
	-60				

ELEVATION	#	•	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO ____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/10/80 BORING NO B-5 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ____ WHICH Monitor (G-105)

TYPE AND LENGTH OF CASING PVC 37.1 FT CASING 2.6 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 372.81 to 397.81 (25 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cuttings
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 392.31
AFTER 6 DAYS 394.61
AFTER 13 DAYS 394.51

Description	Elevation	*	•	N
	+3			
GROUND SURFACE 407.31	0			
Silt (topsoil) Brown		1	D	3' Spn.
Tan		2	D	4/4
	-5			
Brown organics			D	4/3
Brown to gray intermittent sand, silt & clay micaceous & oxidation throughout		3	M	2/2
	-10			
Silty Sand		4	M	2/1
Gray to brown 2" clay lense @ 13 ft.		5	M	3/1
	▼ -15			

Description	Elevation	*	•	N
Sand Brown very fine grained micaceous		6	W	4/4
		7		5/7
390.31				
Sand (arkosic) Gray micaceous	-20	8		5/5
Brown				
	-25			
Tan fine to medium grained gravel throughout		9		7/6
	-30			
medium grained w/gravel		10		5/5

All Samples Taken with 2 Inch O.D. Split
Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery
N - Blow Count NR - No Recovery

LPC-34 3/79

St. Clair County Dead Creek/Cahokia B-5 (G-105)	ELEVATION	*	•	N	WELL DESIGN		ELEVATION	*	•	N	WELL DESIGN
Sand & Gravel (arkosic) Gray medium grained sand & fine grained gravel 370.81	-35	11	W	5/6			-65				
Boring complete	-40						-70				
	-45						-75				
	-50						-80				
	-55						-85				
	-60						-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 2 SH.

COUNTY St. Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/15/80 BORING NO B-6 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-106)

TYPE AND LENGTH OF CASING PVC 42.4 FT CASING 2.4 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 366.67 to 401.67 (35 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cuttings
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 390.67
AFTER 1 DAYS 394.07
AFTER 7 DAYS 394.17

Description	Elevation	Depth	#	•	N
GROUND SURFACE	406.67	+3 / 0			
Gravel & asphalt Brown to black w/silty topsoil throughout				D	3' Spn.
				D	2/3
	402.17	-5			
Silt Light tan micaceous				D	3/2
Tan to black (strong chemical odor)			1	M	3/2
Gray to black	395.17	-10	2	M	2/1
Silty Sand Gray to black (chemical odor)		-15	3	M	5/5
Sand Black (strong chemical color & odor)		▼	4	W	1/6
			5	W	5/6
	387.17	-20			
Sand (arkosic) Gray fine to medium grained subangular, poorly sorted, chemical odor			6	W	3/2
		-25			2/3
chemical colored hues		-30	7	W	5/11

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery

LPC-34 3/79

St. Clair County
Dead Creek/Cahokia
B-6 (G-106)

	ELEVATION		•	N	WELL DESIGN
Sand & Gravel Gray coarse grained w/wood & coal fragments throughout	-35			8/10	
	-40		NR		
365.17					
Boring complete	-45				
	-50				
	-55				
	-60				

ELEVATION		•	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG SH. 1 of 2 SH.

COUNTY St. Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/16/80 BORING NO B-7 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-107)

TYPE AND LENGTH OF CASING PVC 35.1 FT CASING 1.3 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 367.05 to 397.05

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 391.35

AFTER 6 DAYS 390.05

AFTER 15 DAYS 393.65

Description	ELEVATION	*	•	N	WELL DESIGN
	+3				
GROUND SURFACE 400.85	0				
Silt (topsoil) Brown		1	D		
Brown to light tan micaceous throughout intermittent clay, silt & sand			D	6/7	
	-5	2	M	3/3	
Silty Sand Tan oxidation		3	M	3/3	
391.35 ▼	-10				
Sand (arkosic) Tan fine grained (containing chemical hues)		4	W	3/3	
	-15				

Description	ELEVATION	*	•	N	WELL DESIGN
Sand (arkosic) Gray to black fine grained micaceous (observably polluted)		5	W	3/5	
		6	W	6/8	
Gray fine to medium grained	-20	7	W	6/9	
	-25	8	W	5/10	
	-30	9	W	7/8	

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

BORING LOG

St.Clair County
Dead Creek/Cahokia
B-7 (G-107)

Description	ELEVATION	#	•	N	WELL DESIGN
Sand (arkosic) Gray fine to medium grained, subangular w/gravel — 364.35	-35				
Boring complete	-40				
	-45				
	-50				
	-55				
	-60				

ELEVATION	#	•	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 2 SH.

COUNTY St.Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/20/80 BORING NO B-8 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ____ WHICH Monitor (G-108)

TYPE AND LENGTH OF CASING PVC 36.4 FT CASING 2.2 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 372.56 to 402.56

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 394.76

AFTER 3 DAYS 395.06

AFTER 11 DAYS 394.16

Description	Elevation	#	•	N
	+3			
GROUND SURFACE 406.76	0			
Silty Clay (topsoil) Brown		1	D	
Silty Sand Tan micaceous w/some clay throughout		2	D	4/4
Sandy Silt 400.76	-5	3	M	5/7
Sand (arkosic) Tan fine grained		4	M	4/4
fine to medium grained	-10	5	M	5/4
(polluted smell)	▼			
augered through to 35 feet		6	W	6/5
	-15			

Description	Elevation	#	•	N
augered through to 35 feet, cuttings indicated sand coarsening with depth				
	-20			
	-25			
	-30			

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

• Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

60

LPC-34 3/79

BORING LOG

St. Clair County Dead Creek/Cahokia B-8 (G-108)	ELEVATION	#	•	N	WELL DESIGN		ELEVATION	#	•	N	WELL DESIGN
augered through to 35 feet	-35										
371.76							-65				
Boring complete	-40						-70				
	-45						-75				
	-50						-80				
	-55						-85				
	-60						-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG

COUNTY St. Clair SITE NO. ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/21/80 BORING NO. B-9 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-109)

TYPE AND LENGTH OF CASING PVC 38.5 FT CASING 3.5 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 370.68 to 397.68 (27 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 392.18

AFTER 2 DAYS 394.38

AFTER 10 DAYS 394.98

Description	Elevation	#	*	N
	+3			
GROUND SURFACE 407.18	0			
Silt (topsoil) Brown to light tan		1	D	
Light tan micaceous & oxidation		2	D	5/4
	-5			
		3	D	6/4
Clayey Silt Tan to gray micaceous 398.68		4	D	4/6
Sand Gray very fine grained (chemical smell) 395.18	-10	5	M	12/9
Sand (arkosic) Gray very fine grained (strong chemical odor)		6	M	11/14
	-15			

Description	Elevation	#	*	N
Sand (sludge) Black 2" metallic zone		7a 7b	W	11/9
		8 PCB	W	5/6
	-20			
		9	W	10/10
		10	W	8/10
		11	W	4/7
	-25			
fine to medium grained w/gravel		12	W	6/7
	-30			
		13	W	4/9

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

BORING LOG

St. Clair County
Dead Creek/Cahokia
B-9 (G-109)

Description	ELEVATION	*	•	N	WELL DESIGN
Sand Black fine to coarse grained w/fine grained gravel (polluted) 370.68	-35		NR	8/13	
Boring complete	-40				
	-45				
	-50				
	-55				
	-60				

ELEVATION	*	•	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 1 SH.

COUNTY St. Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/22/80 BORING NO. B-10 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ____ WHICH Monitor (G-110)

TYPE AND LENGTH OF CASING PVC 31.3 FT CASING 1.3 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 377.14 to 402.14 (25 feet slotted)

ANNULUS FILL MATERIAL
ABOVE PACKING Cutting
PACKING Bentonite
SCREEN 3/8" Gravel

GROUND WATER EL.
AT COMPLETION 395.14
AFTER 1 DAYS 394.74
AFTER 9 DAYS 394.34

Description	Elevation	#	•	N	Well Design
	+3				
GROUND SURFACE 407.14	0				
Sandy Silt (topsoil) Brown to light tan		1	D		
Tan w/gravel throughout (disturbed)		2	D	3/2	
403.14	-5				
Sandy Silt Brown to gray micaceous		3	D	4/3	
Tan to gray intermittent clayey, sand & silt		4	M	2/2	
	-10				
Gray to tan oxidation		5	M	5/5	
395.14 ▼					
Silty Sand (arkosic) Tan fine grained micaceous		6	W	8/6	
392.14	-15				
Sand (arkosic) Tan fine grained		7	W	4/6	
		8	W	5/4	
	-20				
Gray fine to medium grained		9	W	5/4	
		10	W	2/8	
	-25				
	-30				
Gray to tan medium to coarse grained		11	W	4/6	
375.64					
Boring complete					

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery

LPC-34 3/79

recycled paper

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/23/80 BORING NO. B-11 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-111)

TYPE AND LENGTH OF CASING PVC 35.5 FT CASING 1.5 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 374.41 to 396.41 (22 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cuttings

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 391.91

AFTER 7 DAYS 394.21

AFTER 8 DAYS 393.91

GROUND SURFACE 408.41

Description	Elevation	#	•	N
	+3			
GROUND SURFACE 408.41	0			
Sandy Silt (topsoil) Brown to tan micaceous throughout		1	D	
Light tan		2	D	4/4
	-5	3	D	4/4
Light tan to gray clay lenses		4	D	3/3
Gray to tan intermittent clay, silt & sand	-10	5	M	3/3
		6	M	3/1
	-15			

Description	Elevation	#	•	N
Clayey Silt Gray micaceous		7	W	1/1
391.91				
Sand (arkosic) Tan fine grained micaceous		8	W	3/4
	-20	9	W	4/4
fine to medium grained w/fine grained gravel	-25	10	W	5/5
Sand & Gravel (arkosic) Tan fine to coarse grained subangular to angular	-30	11	W	7/11

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery
N - Blow Count NR - No Recovery

LPC-34 3/79

BORING LOG

St. Clair County Dead Creek/Cahokia B-11 (G-111)	ELEVATION	#	•	N	WELL DESIGN
Sand & Gravel (arkosic) Tan medium to coarse grained sand & fine to coarse grained gravel 371.91	-35	12	W	12/14	
Boring complete	-40				
	-45				
	-50				
	-55				
	-60				

ELEVATION	#	•	N	WELL DESIGN
-65				
-70				
-75				
-80				
-85				
-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG

SH. 1 of 2 SH.

COUNTY St. Clair SITE NO. ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/29/80 BORING NO. B-12 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES X NO ______ WHICH Monitor (G-112)

TYPE AND LENGTH OF CASING PVC 37.8 FT CASING 2.7 FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS 372.62 to 394.62 (22 feet slotted)

ANNULUS FILL MATERIAL

ABOVE PACKING Cutting

PACKING Bentonite

SCREEN 3/8" Gravel

GROUND WATER EL.

AT COMPLETION 396.72

AFTER 12 DAYS 394.12

AFTER ______ DAYS ______

Description	Elevation	*	•	N	Well Design
	+3				
GROUND SURFACE 407.72	0				
Fill Black asphaltic (disturbed)					
	-5	1	M		
400.72					
Clay w/Silt Gray poorly indurated organics		2	M	5/5	
	-10	3	M	2/4	
396.47 ▼					
Silt Gray micaceous		4	W	2/2	
	-15				

Description	Elevation	*	•	N	Well Design
Silt Gray micaceous		5	W	2/7	
390.72					
Sand (arkosic) Gray fine grained w/silt throughout		6	W	5/4	
	-20				
Tan		7	W	4/5	
	-25				
Gray fine to medium grained		8	W	6/7	
	-30				
fine to coarse grained		9	W	10/13	

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

• Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

BORING LOG

St. Clair County
Dead Creek/Cahokia
B-12 (G-112)

Description	ELEVATION	#	•	N	WELL DESIGN
Sand & Gravel (arkosic) Gray fine to coarse grained	-35	10	W	16/22	
371.22					
Boring complete	-40				
	-45				
	-50				
	-55				
	-60				

	ELEVATION	#	•	N	WELL DESIGN
	-65				
	-70				
	-75				
	-80				
	-85				
	-90				

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO P-1 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES ______ NO X WHICH ______

TYPE AND LENGTH OF CASING ______ . ______ FT CASING ______ FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS ______

ANNULUS FILL MATERIAL

ABOVE PACKING ______

PACKING ______

SCREEN ______

GROUND WATER EL.

AT COMPLETION ______

AFTER ______ DAYS ______

AFTER ______ DAYS ______

Description	Elevation	#	•	N	WELL DESIGN
	+3				
GROUND SURFACE 401.03	0				
Silt Discolored chemical odor 400.03		1			
		2			
Clayey Silt Black chemical odor (strong @ 2 feet) 398.03		3			
		4			
	-5	5			
Silt Gray (wore mask) 395.03		6			
		7			
Clayey Sandy Silt Gray 393.03		8			
			NR		
Sand 392.03	-10				
Boring complete					
	-15				

Right-hand elevation scale: -20, -25, -30

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data — PR - Partial Recovery

N - Blow Count — NR - No Recovery

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG

COUNTY St. Clair SITE NO. ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO P-2 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES ______ NO X WHICH ______

TYPE AND LENGTH OF CASING ______ . ______ FT CASING ______ FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS ______

ANNULUS FILL MATERIAL

ABOVE PACKING ______

PACKING ______

SCREEN ______

GROUND WATER EL.

AT COMPLETION ______

AFTER ______ DAYS ______

AFTER ______ DAYS ______

Description	Elevation (depth)
	+3
GROUND SURFACE 399.70	0
Clayey Silt Gray	
	-5
391.70 Sand (arkosic) Tan fine grained	
390.70	
Boring complete	-10
	-15

Second column elevation scale: -20, -25, -30

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

• Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

70

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG

SH. 1 of 1 SH.

COUNTY St. Clair SITE NO ______ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO P-3 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES ____ NO X WHICH ____

TYPE AND LENGTH OF CASING ______ ______ FT CASING ______ FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS ______

ANNULUS FILL MATERIAL

ABOVE PACKING ______

PACKING ______

SCREEN ______

GROUND WATER EL.

AT COMPLETION ______

AFTER ______ DAYS ______

AFTER ______ DAYS ______

GROUND SURFACE 400.67

Description	Elevation	Sample #	•	N	Well Design
Silt Black, orange & green 399.67	0	1, 2			
Clayey Silt Gray chemical odor 395.67		3, 4			
Silt Gray micaceous 394.67	-5	5, 6			
Clayey Silt Gray micaceous 393.17		7, 8			
Sand (arkosic) Gray fine grained 392.67	-10				
Boring complete					

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

• Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

recycled paper

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 1 SH.

COUNTY St. Clair — SITE NO ______ — PREPARED BY Ron St. John

SITE Dead Creek/Cahokia — BORED BY Doug Tolan

DATE 10/30/80 — BORING NO P-4 — HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL — YES ____ NO X WHICH ______

TYPE AND LENGTH OF CASING ______ . ______ FT — CASING ______ FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS ______

ANNULUS FILL MATERIAL
ABOVE PACKING ______
PACKING ______
SCREEN ______

GROUND WATER EL.
AT COMPLETION ______
AFTER ______ DAYS ______
AFTER ______ DAYS ______

Description	Bottom Elevation	Sample #
GROUND SURFACE	399.72	
Sandy, Clayey, Silt Discolored	398.72	1
Clayey Silt Gray to black oxidation	397.72	2, 3
Silty Clay Gray oxidation	396.72	4, 5
Clayey Silt Gray oxidation	395.72	6, 7
Clayey, Sandy, Silt Gray	393.72	8
Silty Clay Gray	392.72	
Sand (arkosic) Gray fine grained	391.22	
Boring complete		

Elevation scale: +3, 0, -5, -10, -15, -20, -25, -30

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data
N - Blow Count
PR - Partial Recovery
NR - No Recovery

72

LPC-34 3/79

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

DIVISION OF LAND/NOISE POLLUTION CONTROL

BORING LOG — SH. 1 of 1 SH.

COUNTY St. Clair SITE NO. ____ PREPARED BY Ron St. John

SITE Dead Creek/Cahokia BORED BY Doug Tolan

DATE 10/30/80 BORING NO P-5 HELPER Ken Bosie

BORING COMPLETED AS MONITOR OR LEACHATE WELL YES ____ NO X WHICH ____

TYPE AND LENGTH OF CASING ____ FT CASING ____ FT ABOVE GROUND LEVEL

SCREENED INTERVAL ELEVATIONS ____

ANNULUS FILL MATERIAL

ABOVE PACKING ____

PACKING ____

SCREEN ____

GROUND WATER EL.

AT COMPLETION ____

AFTER ____ DAYS ____

AFTER ____ DAYS ____

Description	Elevation	Sample #	•	N	Well Design
	+3				
GROUND SURFACE 399.65	0				
Silt, Orange, black & gray — 398.65		1			
Clayey Silt, Gray, oxidation — 397.65		2, 3			
Silty Clay, Gray, organics & oxidation — 396.65	▼ -5	4, 5			
Silt, Gray, micaceous & clay lenses — 394.65		6, 7			
Clayey Silt, Gray to black — 393.65		8, 9			
Silt, Gray to black, micaceous — 389.85	-10				
Sand (arkosic), Gray, fine grained — 389.65					
Boring complete	-15				

Right elevation scale: -20, -25, -30

All Samples Taken with 2 Inch O.D. Split Spoon Sampler Unless Otherwise Indicated

* Miscellaneous Data PR - Partial Recovery

N - Blow Count NR - No Recovery

LPC-34 3/79

Appendix 2 - Grain Size and Permeability Analysis

Time Collected ______

Laboratory ID No. B 24219

Date Collected 10/9/80

Date Received Nov.14.1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-1,0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
_ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
_ OTHER ______

DATE ANALYSIS COMPLETED ______

DATE ANAYSIS REPORTED ______

TEST RESULTS

permeablilty:

4.5×10^{-6} cm/sec

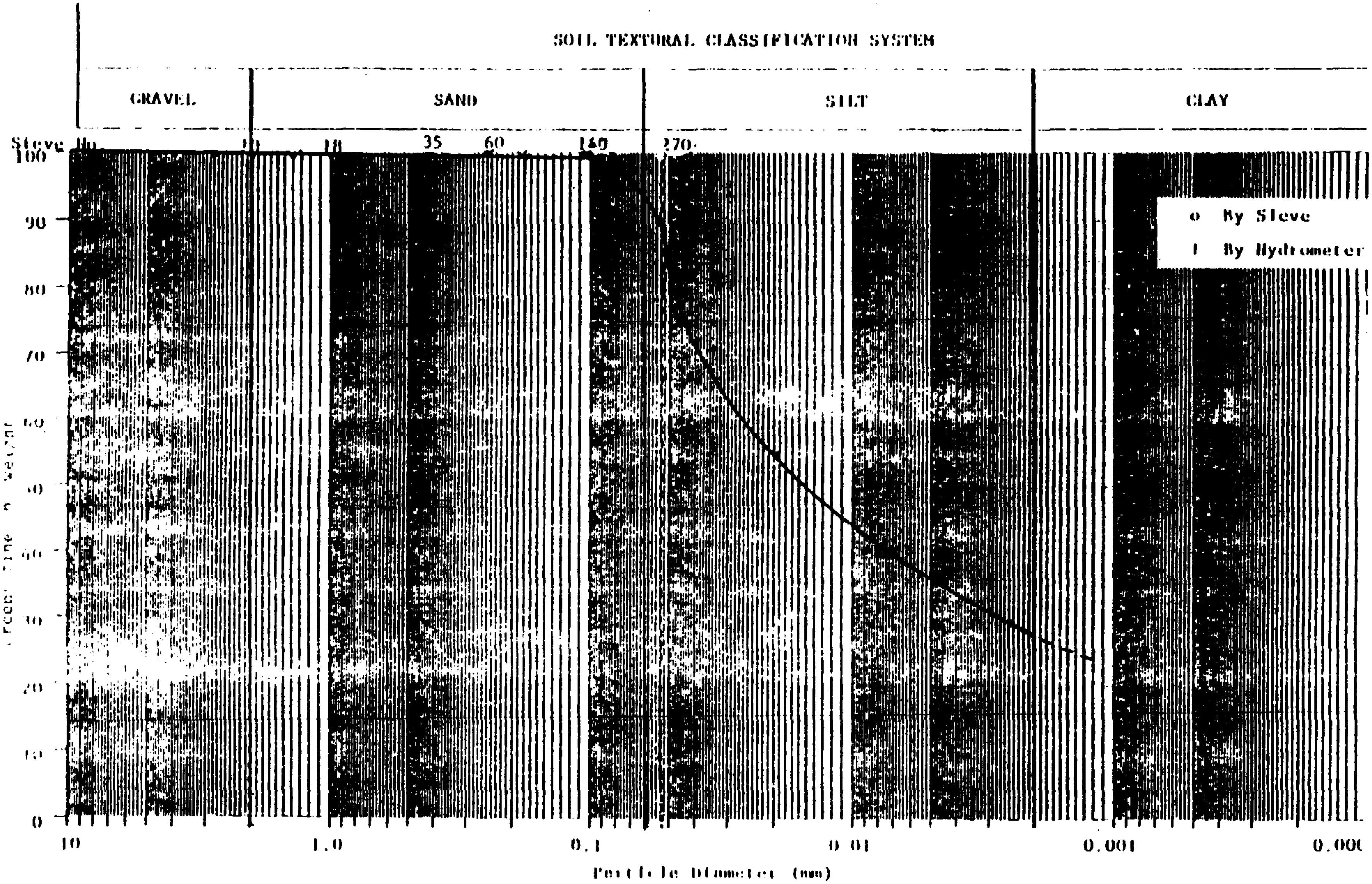
grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.96	5.0	.0182	55.00
18	1.00	99.90	20.0	.0098	43.41
35	.417	99.84	60.0	.0055	37.63
60	.250	99.59	240.	.0025	29.91
140	.105	98.49	360.	.0022	28.95
270	.053	87.38			
pan					

COMMENTS ______

recycled paper

DEC 26 1980



Sample No. (Field) ________________ Sample No. (Lab.) ________________ Date ________________

Illinois Environmental Protection Agency---DLS

Tested By ________

% Gravel .04 % Sand 7.0 % Silt 64.03 % Clay 28.95 Name: Clayey Silt, w/some sand

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24220

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code ____________

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-3, S-2, 5.0-6.5

Physical Observations, Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
__ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

permeablilty: 9.8×10^{-6} cm/sec

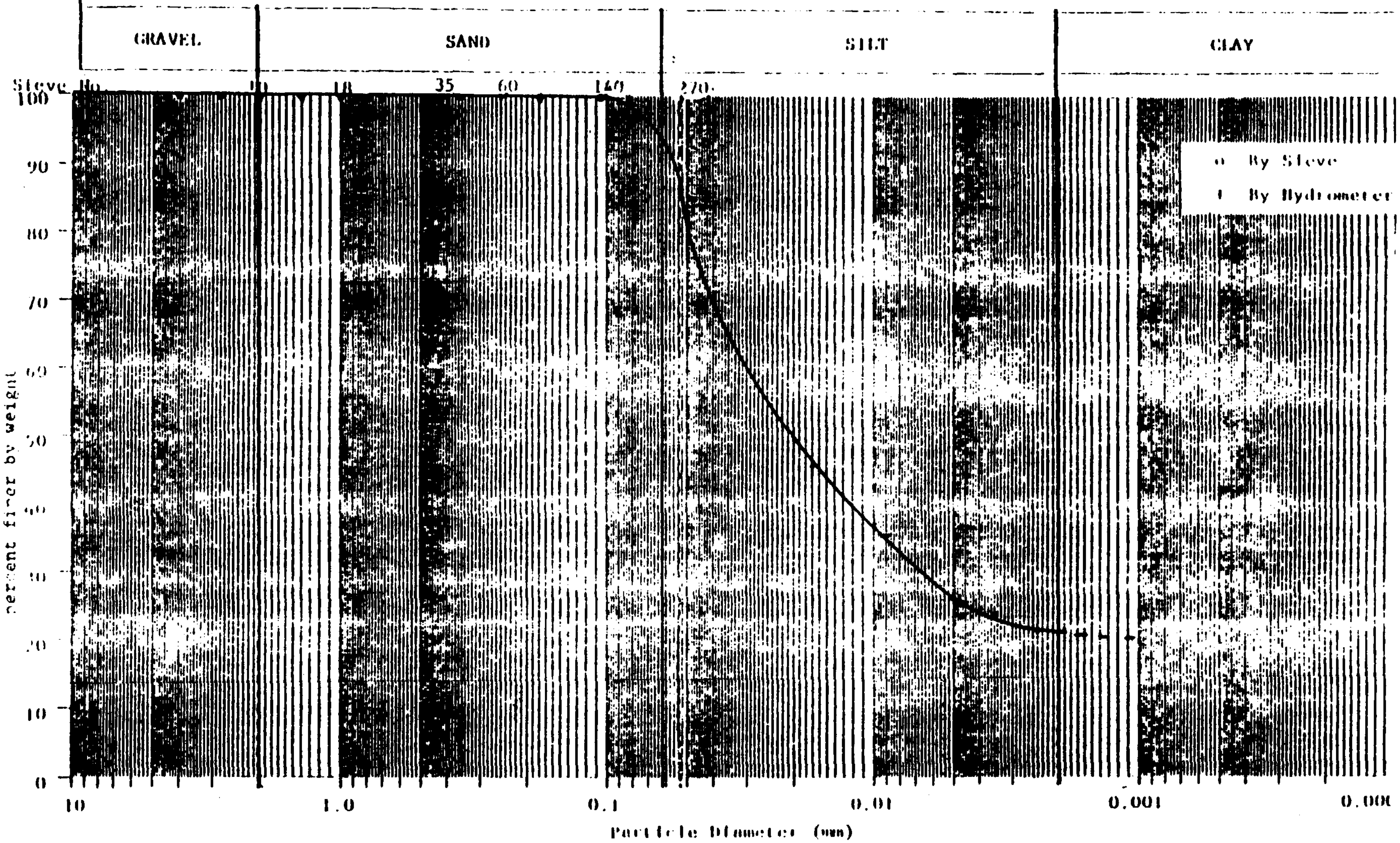
grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0170	45.30
18	1.00	99.98	20.0	.0092	36.00
35	.417	99.89	60.0	.0051	26.71
60	.250	99.80	240.	.0024	22.07
140	.105	99.31	360.	.0019	22.07
270	.053	87.02			
pan					

COMMENTS

LPC 2(7/80

SOIL TEXTURAL CLASSIFICATION SYSTEM



Sample No. (Field) ______________ Sample No. (Lab.) ______________ Date ______________

Illinois Environmental Protection Agency---DLS

Tested By ________

% Gravel 0 % Sand 7.0 % Silt 70.93 % Clay 22.07 Name: Clayey Silt, w/some sand

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24221

Date Collected 10/9/80 Date Received Nov.14.1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-3, S-3, 7.5-9.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
__ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

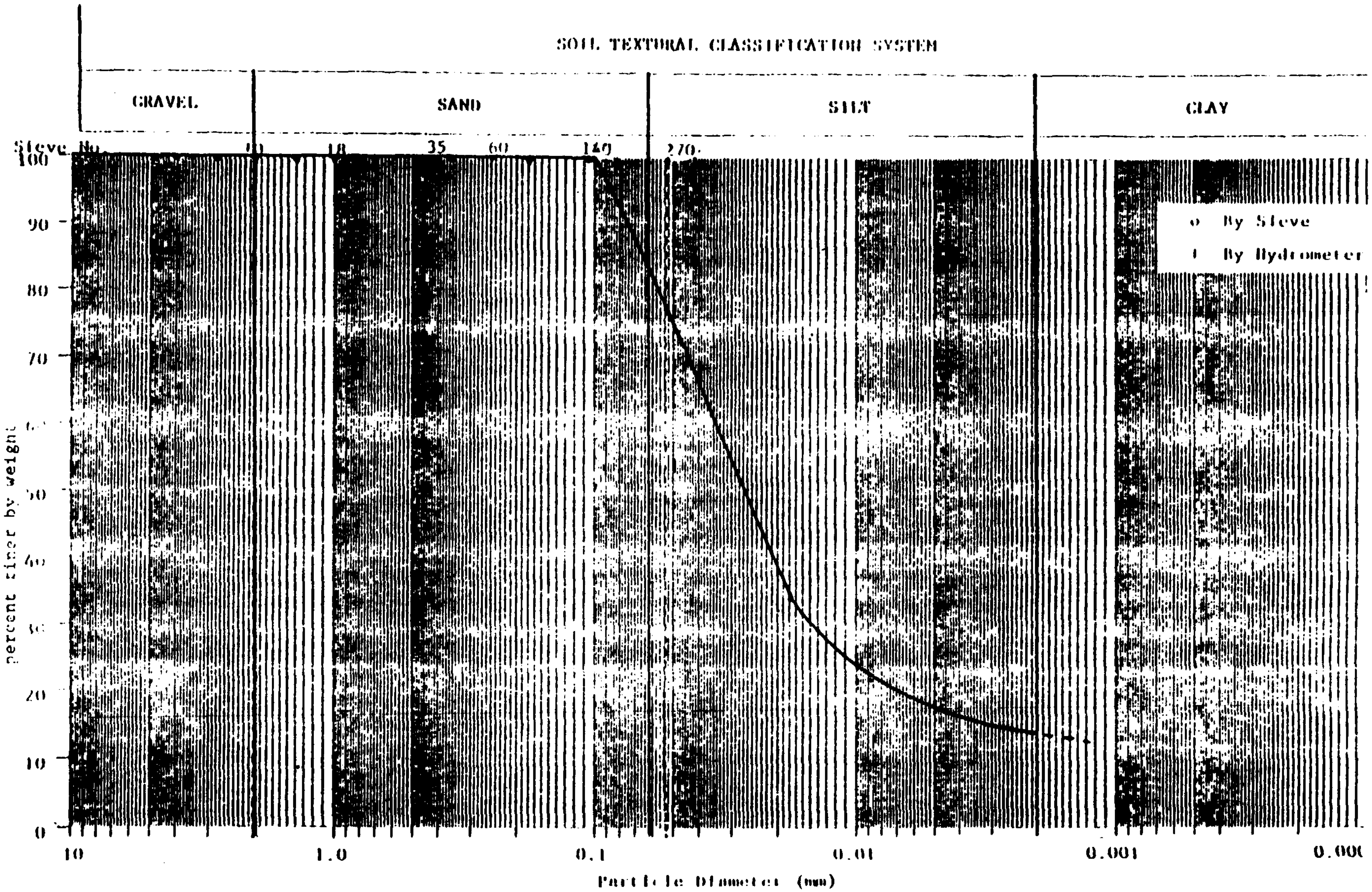
TEST RESULTS

permeability: 5.4×10^{-3} cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0186	34.49
18	1.00	100.00	20.0	.0088	22.32
35	.417	99.94	60.0	.0050	18.26
60	.250	99.89	240.	.0025	16.13
140	.105	99.11	360.	.0020	15.21
270	.053	77.74			
pan					

COMMENTS ______________________________



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Illinois Environmental Protection Agency---DLS

Tested By ____________

% Gravel 0 % Sand 18 % Silt 66.79 % Clay 15.21 Name: Sandy Silt w/some clay

V-78

Time Collected ____________

Laboratory ID No. B 24238

Date Collected 10/20/80

Date Received Nov.14,1980

Division Program Code ____________

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-8, S-1, 0.0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

permeablilty:

____________ cm/sec

grain size:

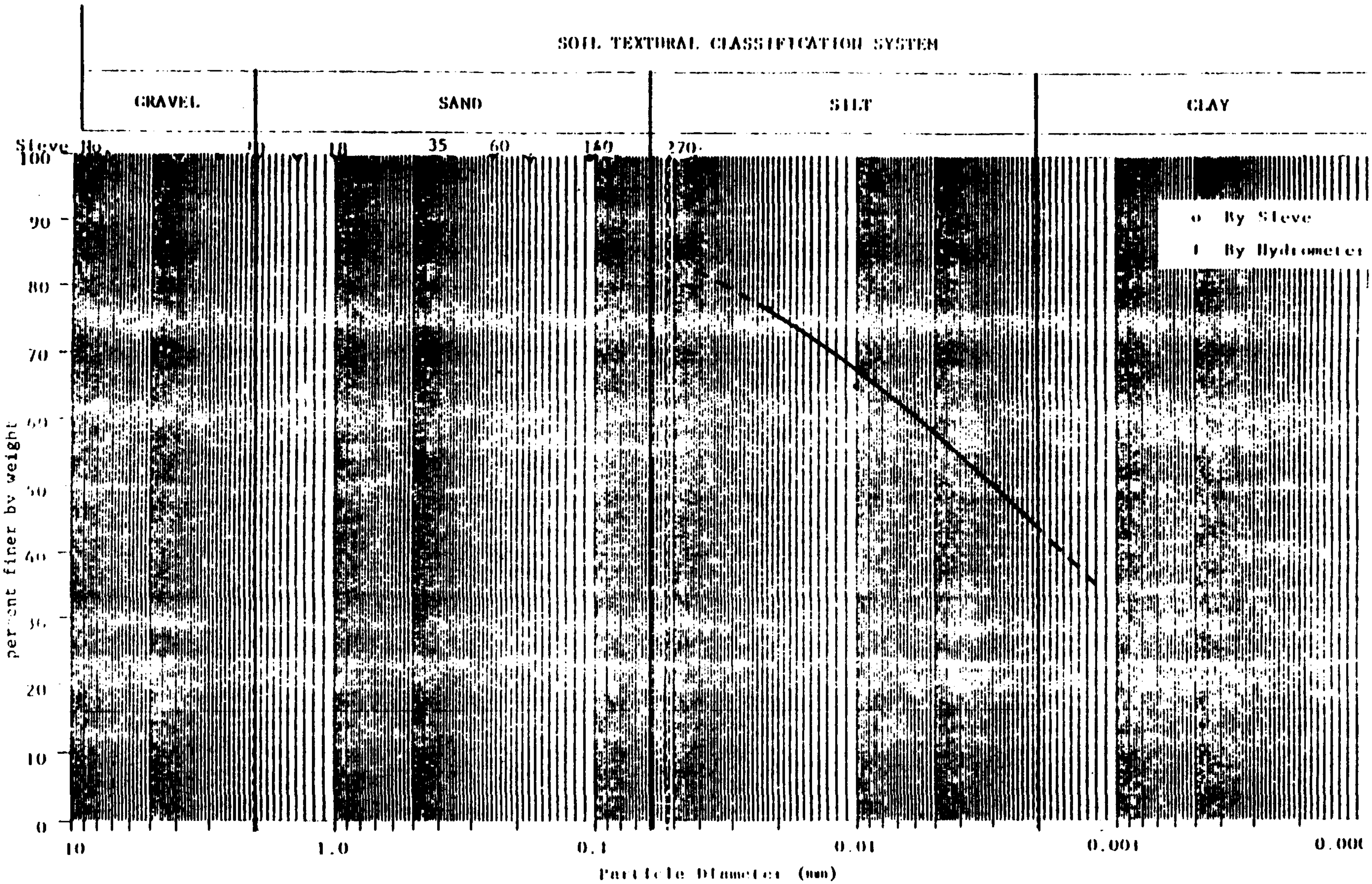
sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0227	77.54
18	1.00	Less than 15%	20.0	.0103	64.47
35	.417	of sample	60.0	.0061	58.37
60	.250	greater than	240.	.0029	48.79
140	.105	.053 mm.	360.	.0023	45.30
270	.053				
pan					

COMMENTS ____________

recycled paper

ecology and environment

LPC 26 7/80



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Tested By ____________

Illinois Environmental Protection Agency---DLS

% Gravel& Sand less than 15% % Silt 39.7 or more % Clay 45.30 Name: Silty Clay

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24239

Date Collected 10/20/80 Date Received Nov.14.1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-8, S-2, 2.5-4.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS

X SIEVE SIZE ANALYSIS

___ UNDISTURBED PERMEABILITY

___ DISTURBED PERMEABILITY

___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

permeablilty:

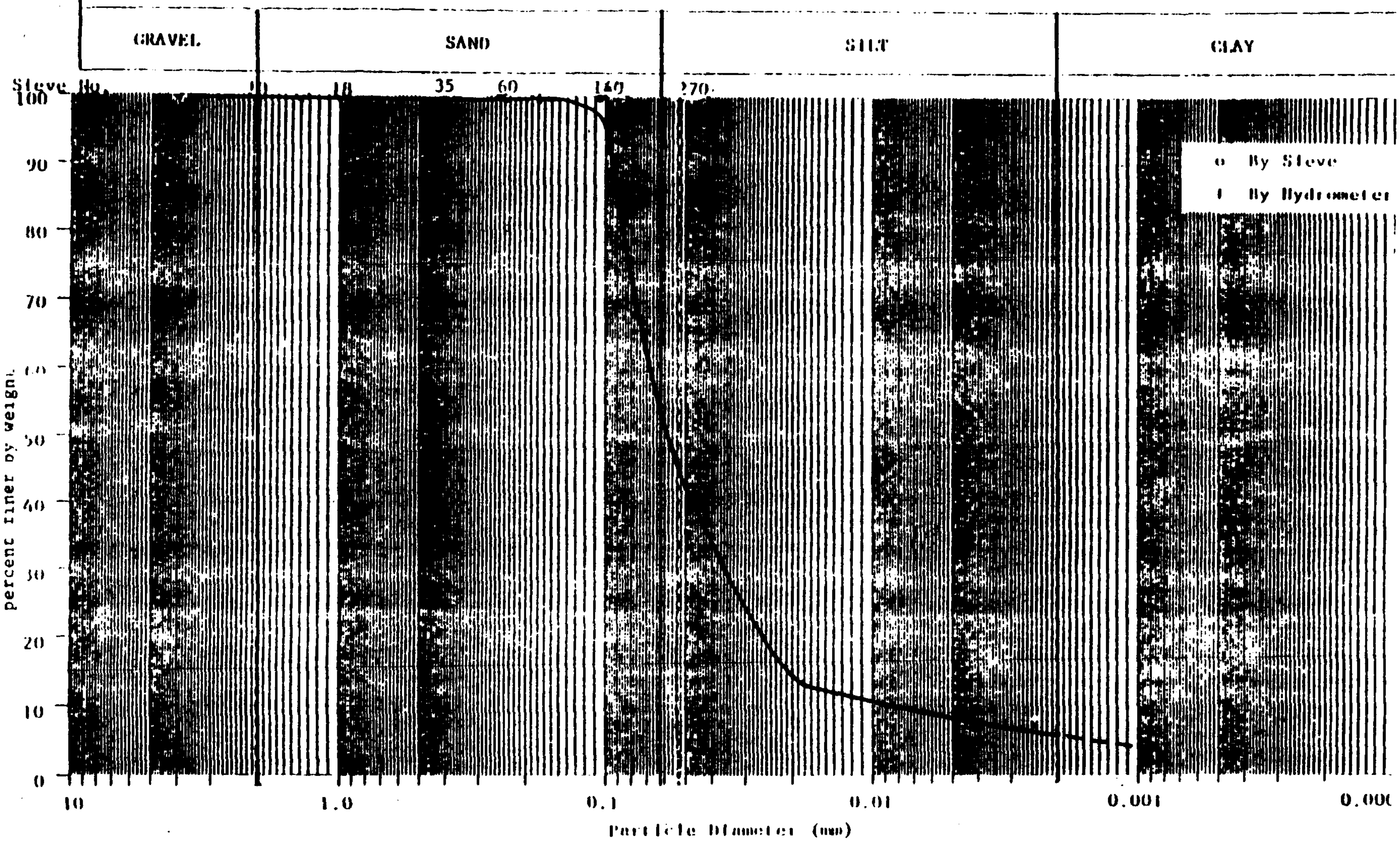
________ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.87	5.0	.0185	13.07
18	1.00	99.55	20.0	.0088	9.80
35	.417	99.26	60.0	.0050	8.17
60	.250	98.98	240.	.0025	7.35
140	.105	95.70	360.	.0020	6.54
270	.053	46.13			
pan					

COMMENTS

SOIL TEXTURAL CLASSIFICATION SYSTEM



Sample No. (Field) ________ Sample No. (Lab.) ________ Date ________

Tested By ________

Illinois Environmental Protection Agency--DLS

% Gravel 0.13 % Sand 48 % Silt 45.33 % Clay 6.54 Name: Silty Sand w/some clay

V-78(

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ________ Laboratory ID No. B 24240

Date Collected 10/20/80 Date Received Nov.14,1980

Division Program Code ________

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) B-8, S-3, 5.0-6.5		
Physical Observations,Remarks		

TESTS REQUESTED

- X HYDROMETER SIZE ANALYSIS
- X SIEVE SIZE ANALYSIS
- ___ UNDISTURBED PERMEABILITY
- ___ DISTURBED PERMEABILITY
- ___ OTHER ________

DATE ANALYSIS COMPLETED ________

DATE ANAYSIS REPORTED ________

TEST RESULTS

permeablilty:

________ cm/sec

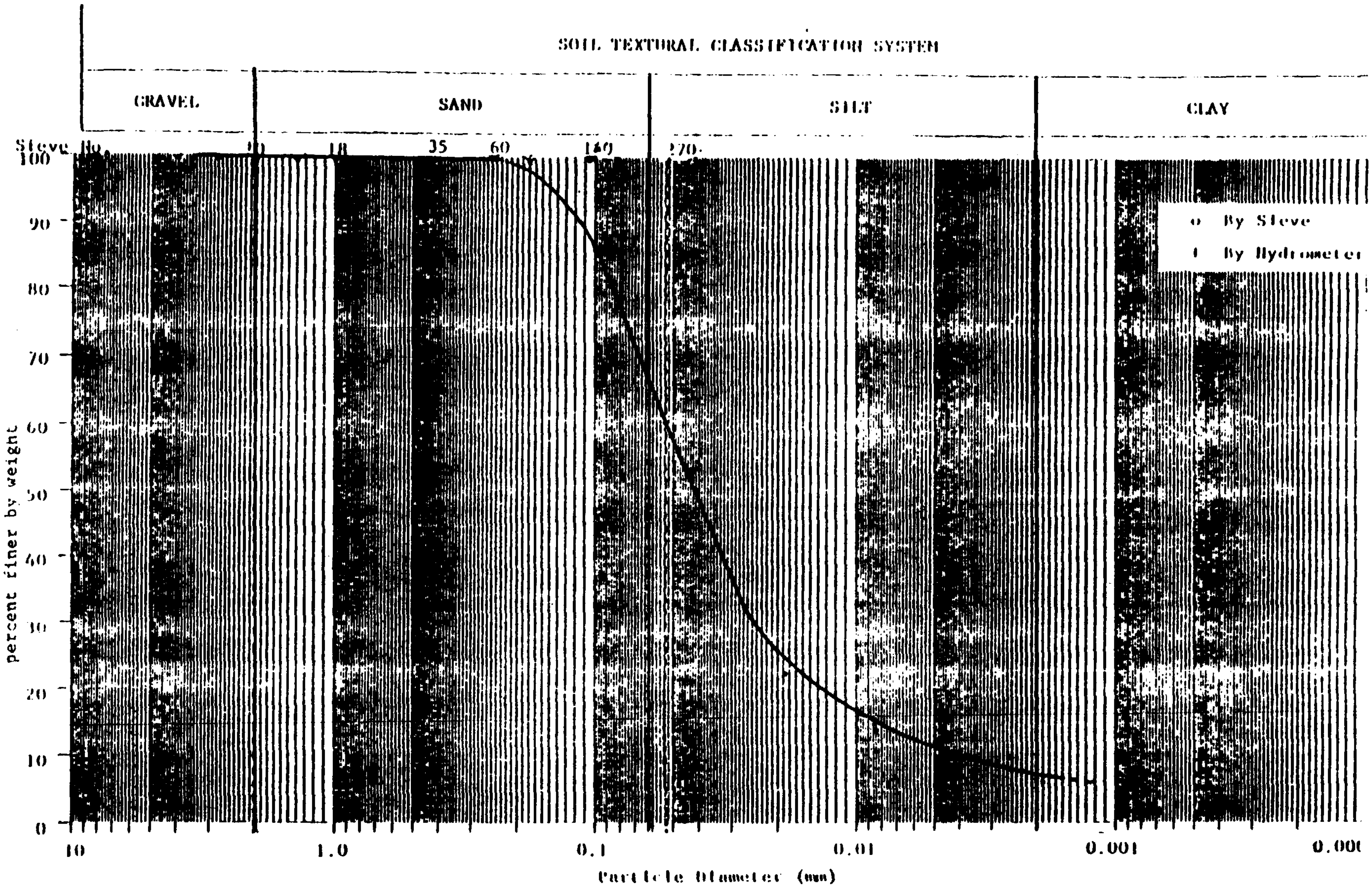
grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.93	5.0	.0188	22.49
18	1.00	99.74	20.0	.0085	13.74
35	.417	99.59	60.0	.0050	11.24
60	.250	99.43	240.	.0025	9.99
140	.105	85.55	360.	.0019	6.25
270	.053	61.59			
pan					

COMMENTS ________

recycled paper ecology and environment

LPC 37 7/80



Sample No. (Field) ________ Sample No. (Lab.) ________ Date ________

Illinois Environmental Protection Agency---DLS

Tested By ________

% Gravel 0.07 % Sand 33 % Silt 60.68 % Clay 6.25 Name: Sandy Silt w/some clay

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24242

Date Collected 10/20/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-8, S-5, 10.0-11.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

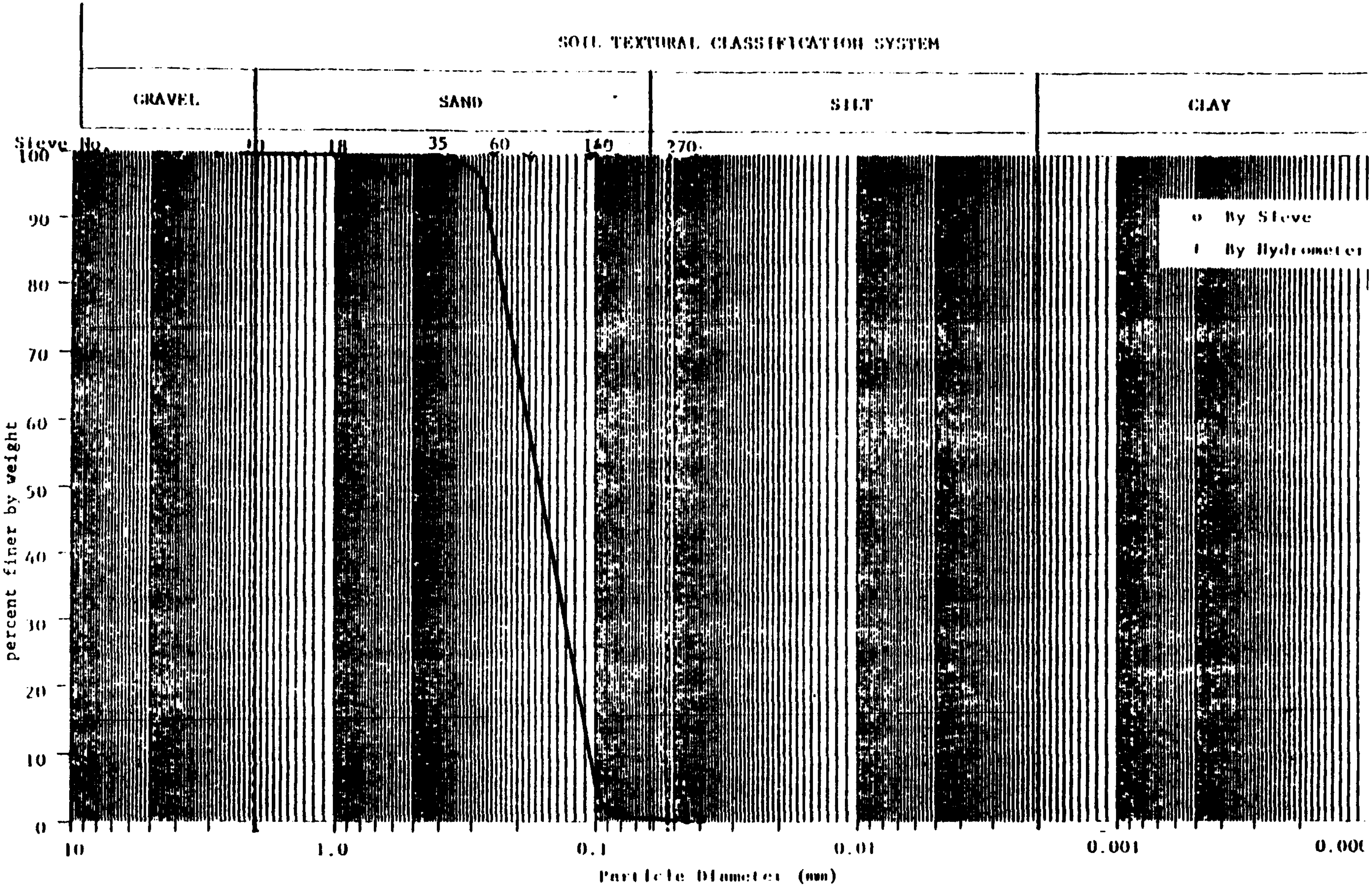
permeabiilty:

______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.98	5.0	NA	
18	1.00	99.93	20.0	Less than	15% of sample
35	.417	99.75	60.0	finer than	.053 mm.
60	.250	79.17	240.		
140	.105	4.97	360.		
270	.053	1.55			
pan					

COMMENTS ______________



Sample No. (Field) ______ Sample No. (Lab.) ______ Date ______

Tested By ______

Illinois Environmental Protection Agency---DLS

% Gravel 0.02 % Sand 98.43 % Silt & Clay 1.55%

Name: Sand

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24230

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-1, 0.0-1.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS

X SIEVE SIZE ANALYSIS

___ UNDISTURBED PERMEABILITY

___ DISTURBED PERMEABILITY

___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

permeablilty:

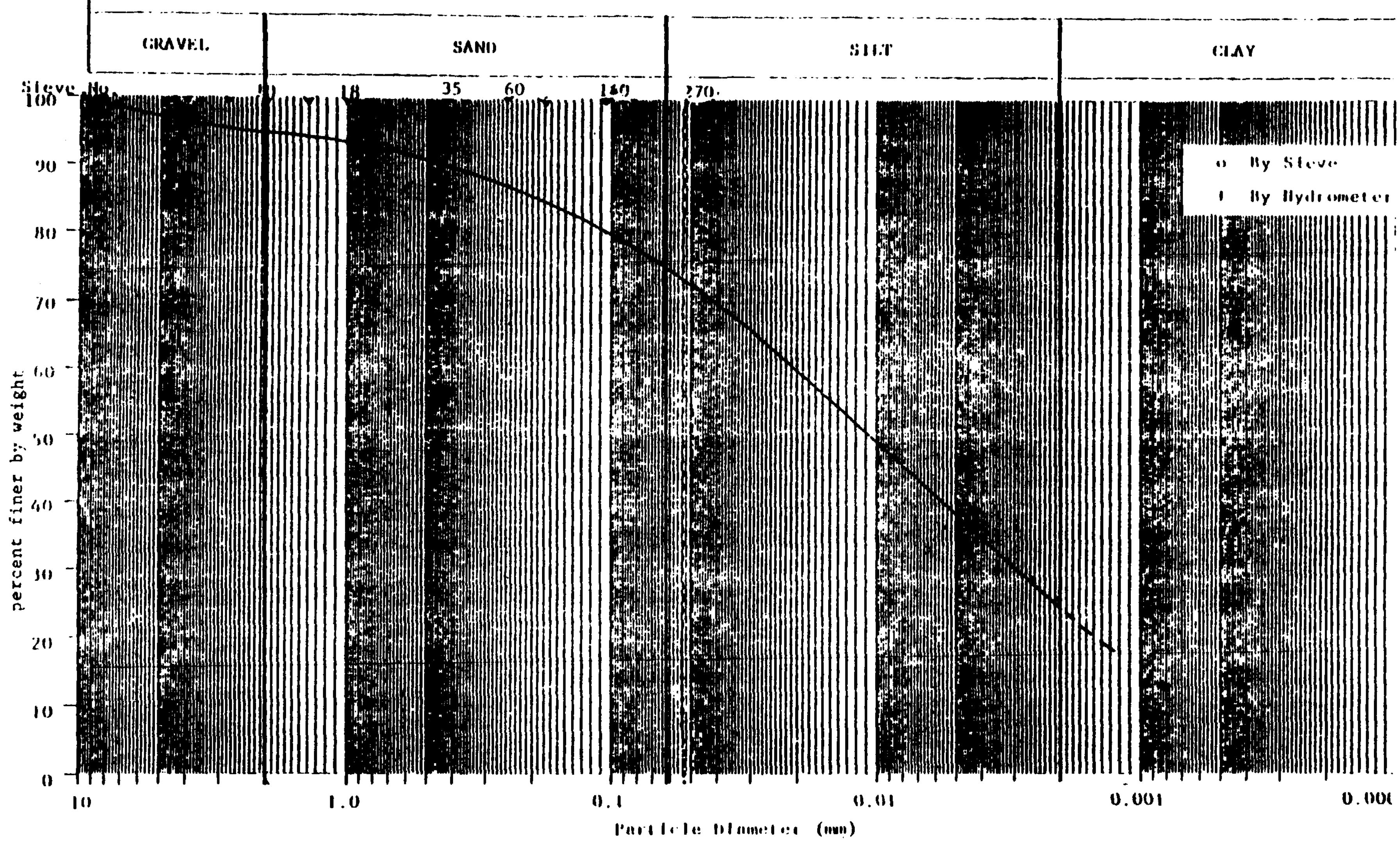
______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	95.38	5.0	.0205	62.46
18	1.00	93.32	20.0	.0098	46.60
35	.417	90.27	60.0	.0055	37.68
60	.250	86.07	240.	.0025	28.75
140	.105	80.38	360.	.0021	26.77
270	.053	75.13			
pan					

COMMENTS ______________

SOIL TEXTURAL CLASSIFICATION SYSTEM



Sample No. (Field) ______ Sample No. (Lab.) ______ Date ______

Tested By ______

Illinois Environmental Protection Agency---DLS

% Gravel 4.62 % Sand 20.0 % Silt 48.61 % Clay 26.77 Name: Sandy, Clayey, Silt

Time Collected ______ Laboratory ID No. B 24231

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-2, 1.0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS

X SIEVE SIZE ANALYSIS

___ UNDISTURBED PERMEABILITY

___ DISTURBED PERMEABILITY

___ OTHER ______

DATE ANALYSIS COMPLETED ______

DATE ANAYSIS REPORTED ______

TEST RESULTS

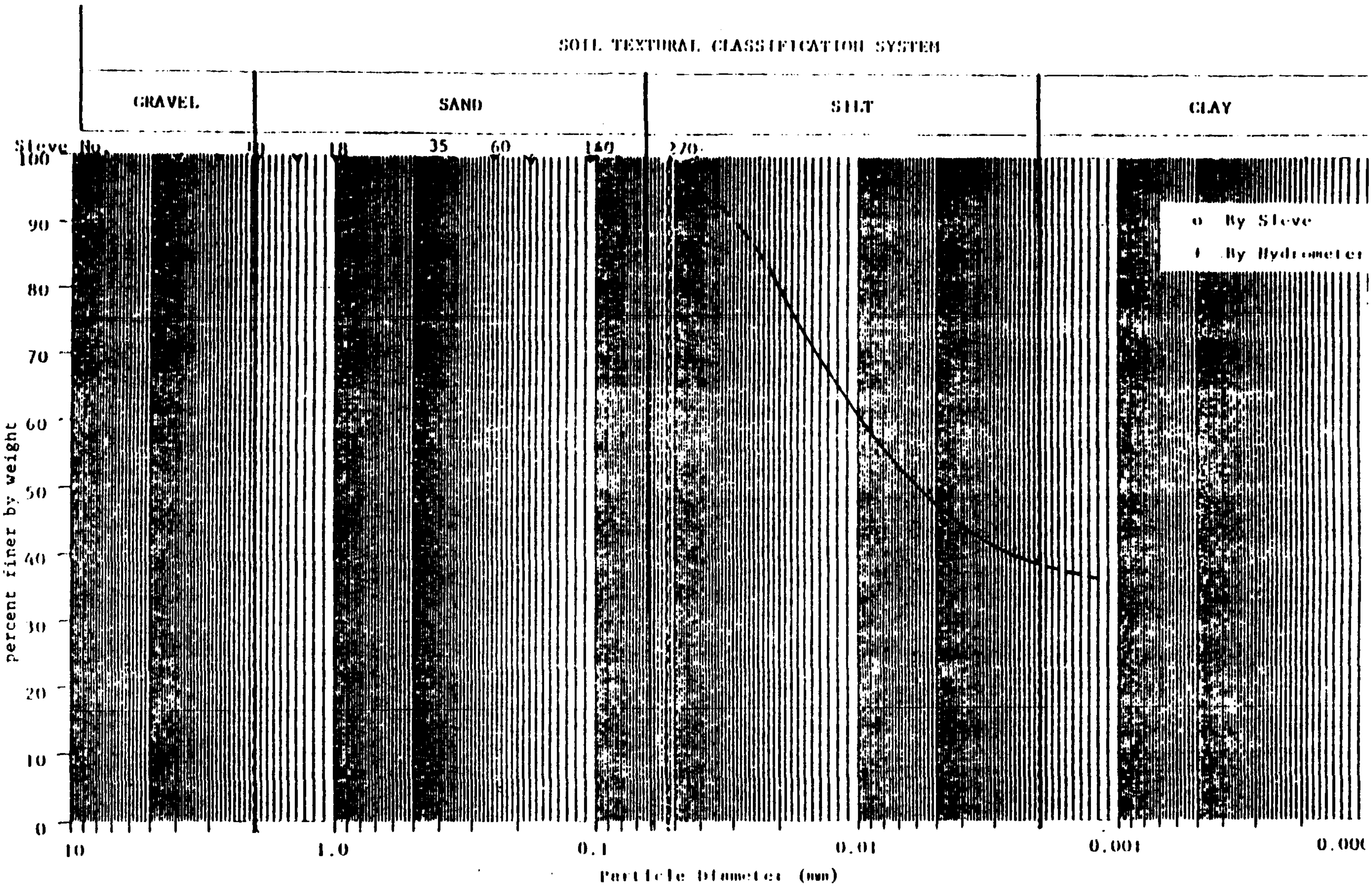
permeablilty:

______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0199	79.69
18	1.00	Less than	20.0	.0095	59.38
35	.417	15% of sample	60.0	.0053	50.00
60	.250	greater than	240.	.0025	42.19
140	.105	.053 mm.	360.	.0021	39.06
270	.053				
pan					

COMMENTS ______



Sample No. (Field) ________________ Sample No. (Lab.) ______________ Date ____________

Tested By ________

Illinois Environmental Protection Agency---DLS

% Gravel & Sand less than 15% % Silt 45.94 or more% Clay 39.06 Name: Clayey Silt

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24232

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-3, 2.0-3.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

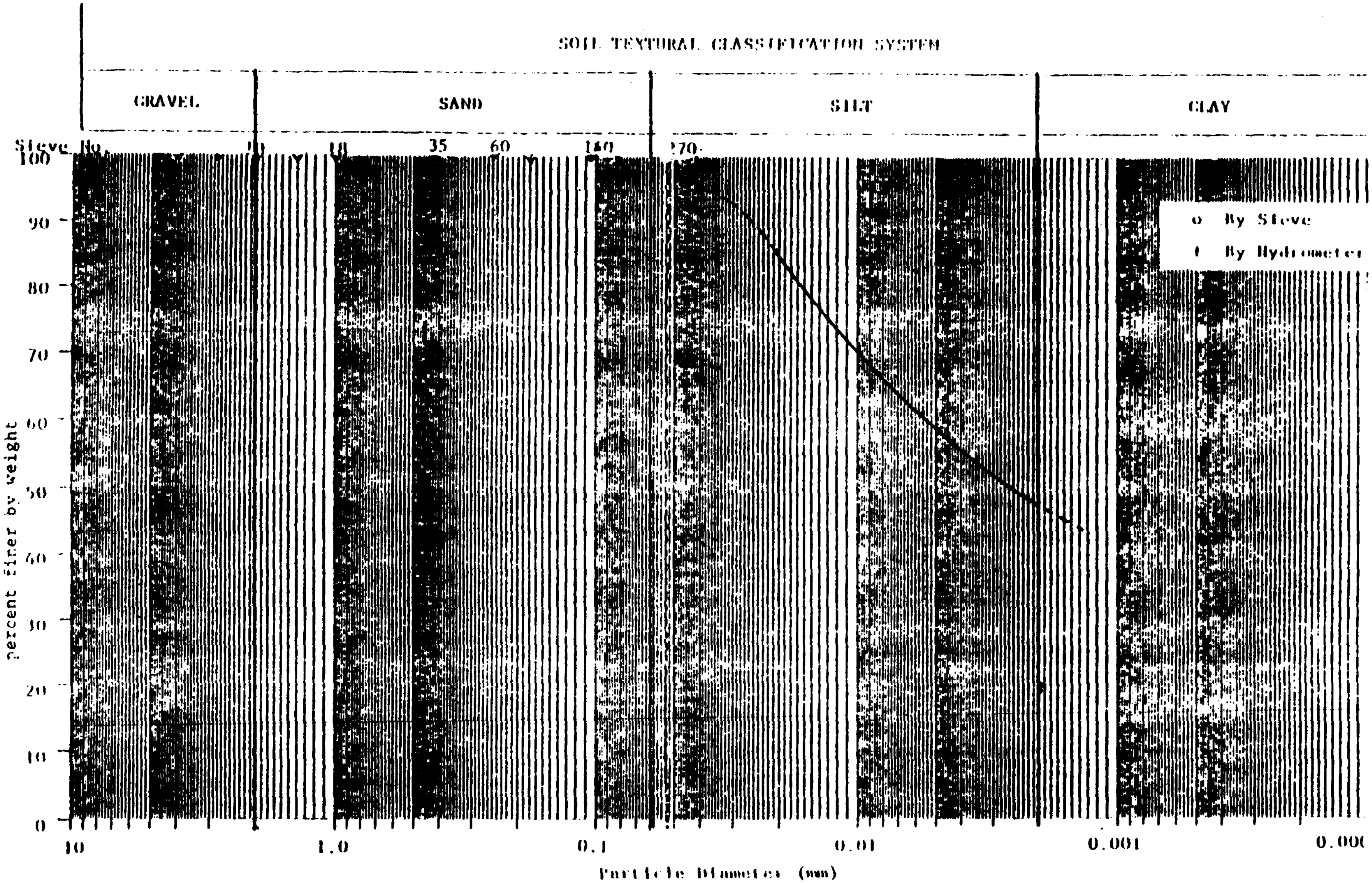
permeablilty:

________ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0209	85.28
18	1.00	Less than	20.0	.0099	70.15
35	.417	15% of	60.0	.0056	61.90
60	.250	sample greater	240.	.0026	50.89
140	.105	than .053 mm.	360.	.0022	48.14
270	.053				
pan					

COMMENTS ____________



Sample No. (Field) ______ Sample No. (Lab.) ______ Date ______

Illinois Environmental Protection Agency --DLS Tested By ______

% Gravel & Sand <u>less than 15%</u> % Silt 36.84 or more % Clay 48.14 Name: Silty Clay

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24233

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ________

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
P-4, S-4, 3.0-4.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
__ DISTURBED PERMEABILITY
__ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

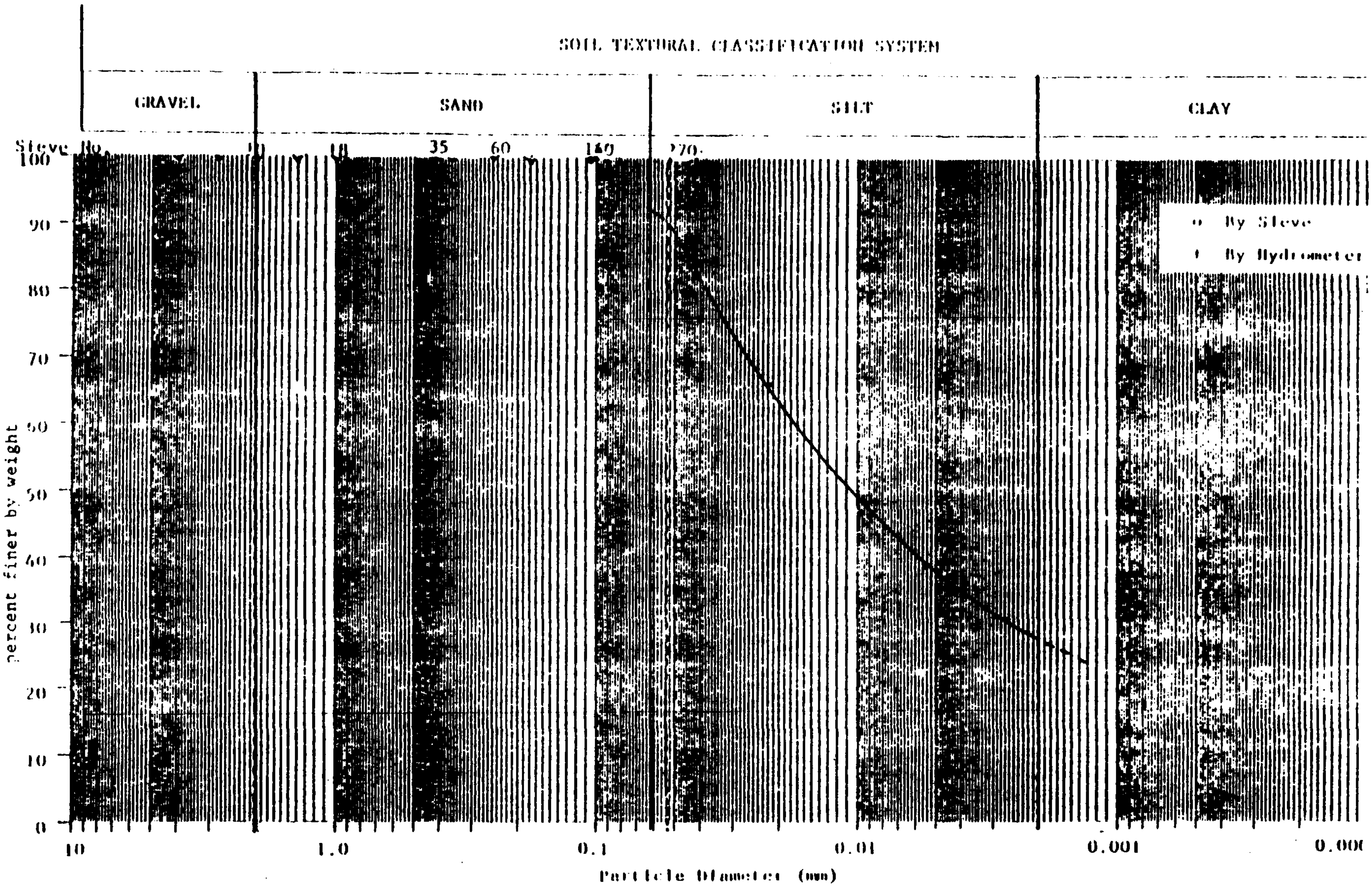
permeablility:

________ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0212	65.66
18	1.00	Less than	20.0	.0091	46.35
35	.417	15% of	60.0	.0055	38.62
60	.250	sample greater	240.	.0027	30.90
140	.105	than .053 mm.	360.	.0022	28.97
270	.053				
pan					

COMMENTS



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Illinois Environmental Protection Agency---DLS

Tested By ____________

% Gravel & Sand less than 15% % Silt 56.03 or more % Clay 28.97 Name: Clayey Silt

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______ Laboratory ID No. B 24234

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

P-4, S-5, 4.0-5.0

Physical Observations,Remarks

TESTS REQUESTED

- X HYDROMETER SIZE ANALYSIS
- X SIEVE SIZE ANALYSIS
- ___ UNDISTURBED PERMEABILITY
- ___ DISTURBED PERMEABILITY
- ___ OTHER ______

DATE ANALYSIS COMPLETED ______

DATE ANAYSIS REPORTED ______

TEST RESULTS

permeabilty:

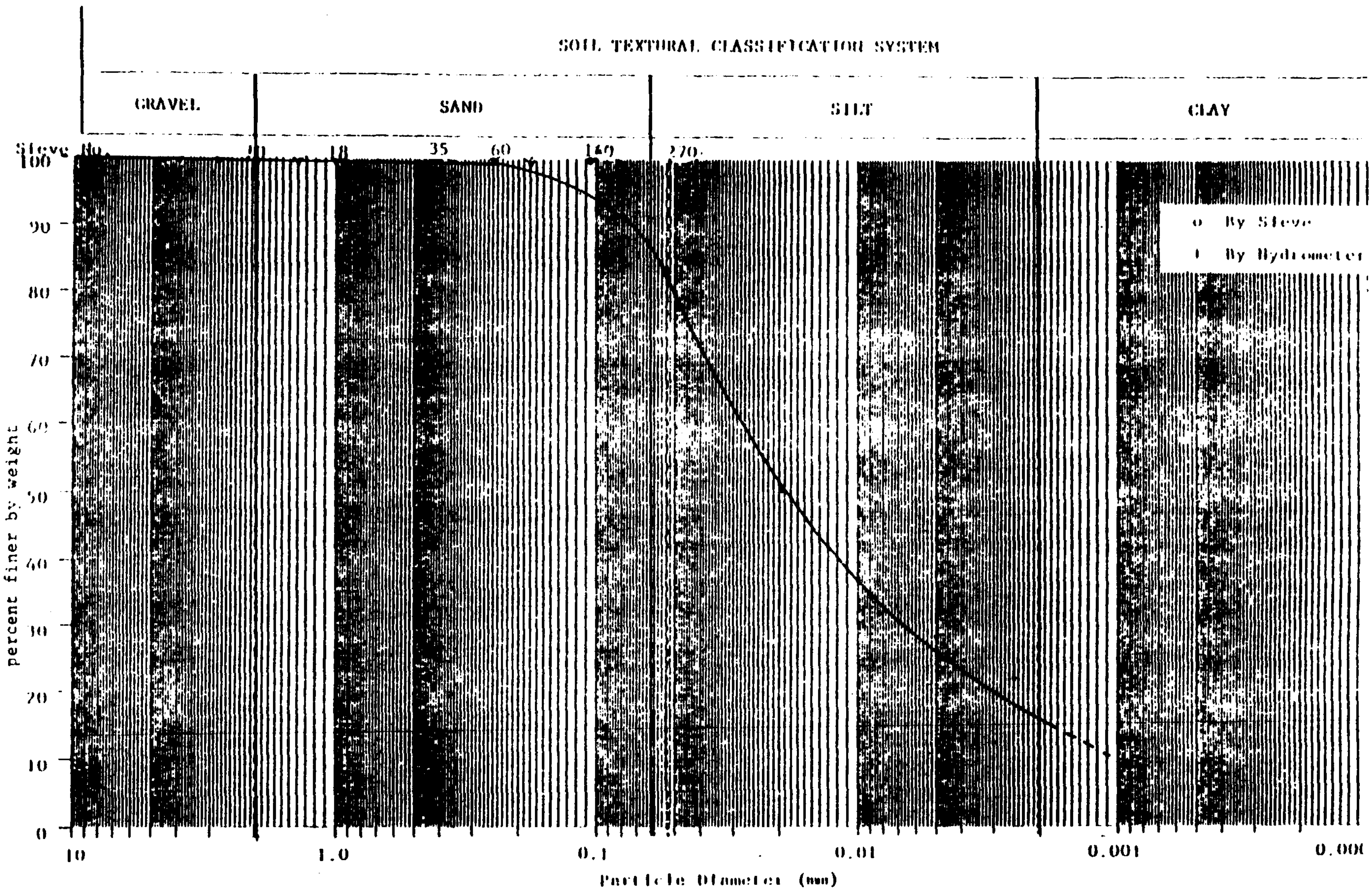
______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0187	50.08
18	1.00	99.86	20.0	.0083	32.91
35	.417	99.48	60.0	.0050	28.62
60	.250	98.48	240.	.0025	22.90
140	.105	95.82	360.	.0019	14.31
270	.053	82.05			
pan					

COMMENTS ______

LPC 2 7/80



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Tested By ____________

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 13 % Silt 77.69 % Clay 14.31 Name: Sandy, Clayey, Silt

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24235

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
P-4, S-6, 5.0-6.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
__ DISTURBED PERMEABILITY
__ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

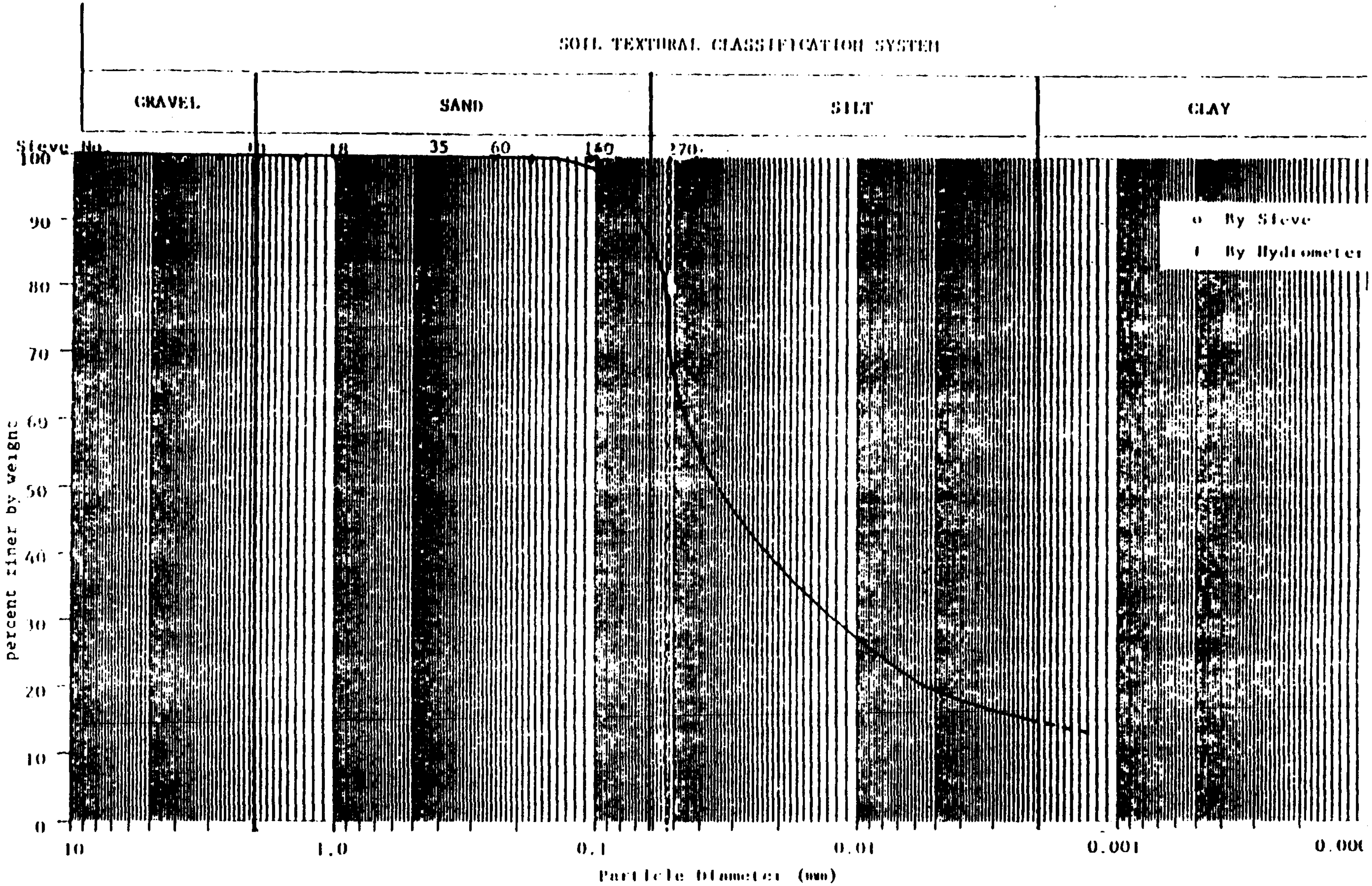
permeablilty:

______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.98	5.0	.0200	38.55
18	1.00	99.88	20.0	.0086	24.19
35	.417	99.61	60.0	.0052	20.41
60	.250	98.98	240.	.0025	16.63
140	.105	97.15	360.	.0021	15.87
270	.053	80.35			
pan					

COMMENTS



Sample No. (Field) ________ Sample No. (Lab.) ________ Date ________

Illinois Environmental Protection Agency --DLS

Tested By ________

% Gravel .02 % Sand 12 % Silt 72.11 % Clay 15.87 Name: Sandy Clayey, Silt

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24236

Date Collected 10/30/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	
Source of Sample (boring number, sample number, depth interval in feet) P-4, S-7, 6.0-7.0		
Physical Observations,Remarks		

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS

X SIEVE SIZE ANALYSIS

___ UNDISTURBED PERMEABILITY

___ DISTURBED PERMEABILITY

___ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

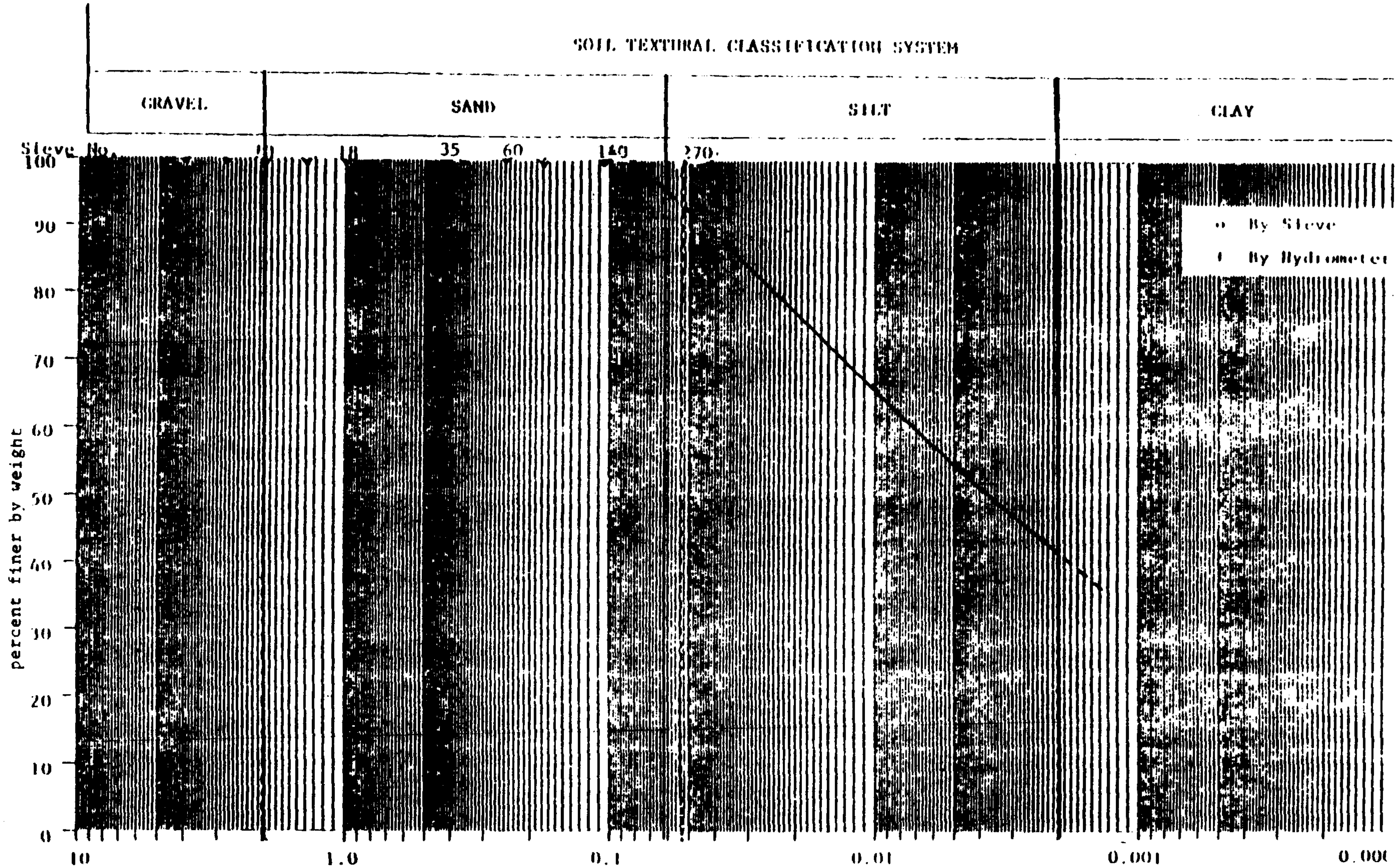
permeablilty:

______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0222	79.14
18	1.00	Less than	20.0	.0101	67.55
35	.417	15% of	60.0	.0060	57.90
60	.250	sample greater	240.	.0029	47.29
140	.105	than .053 mm.	360.	.0023	44.39
270	.053				
pan					

COMMENTS ____________



Particle Diameter (mm)

Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Illinois Environmental Protection Agency---DLS Tested By ____________

% Gravel & Sand less than 15% % Silt 40.0 or more % Clay 42.0 Name: Silty Clay

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24222

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-3, S-4, 10.0-11.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS

X SIEVE SIZE ANALYSIS

___ UNDISTURBED PERMEABILITY

___ DISTURBED PERMEABILITY

___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

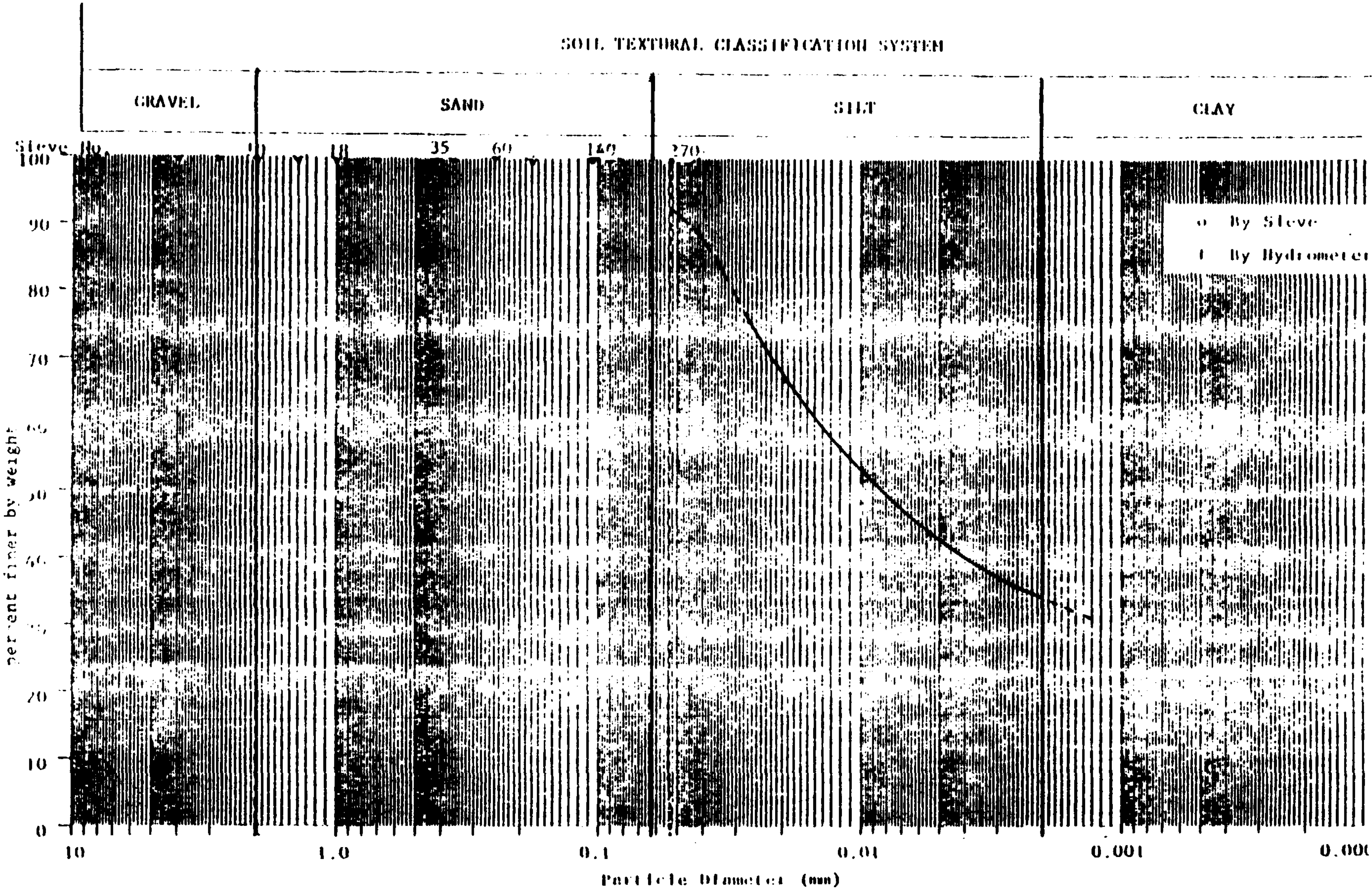
permeability:

________ cm/sec

grain size:

sieve no.	sieve opening (mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	NA	5.0	.0193	66.71
18	1.00	Less than 15%	20.0	.0098	52.01
35	.417	of sample	60.0	.0055	44.10
60	.250	larger than	240.	.0025	37.31
140	.105	.053 mm.	360.	.0022	35.05
270	.053				
pan					

COMMENTS ______________



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Tested By ____________

Illinois Environmental Protection Agency---DLS

% Gravel & Sand less than 15% % Silt 49.95 or more % Clay 35.05 Name: Clayey Silt

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________

Laboratory ID No. B 24223

Date Collected 10/9/80

Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-5, 12.5-14.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
__ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

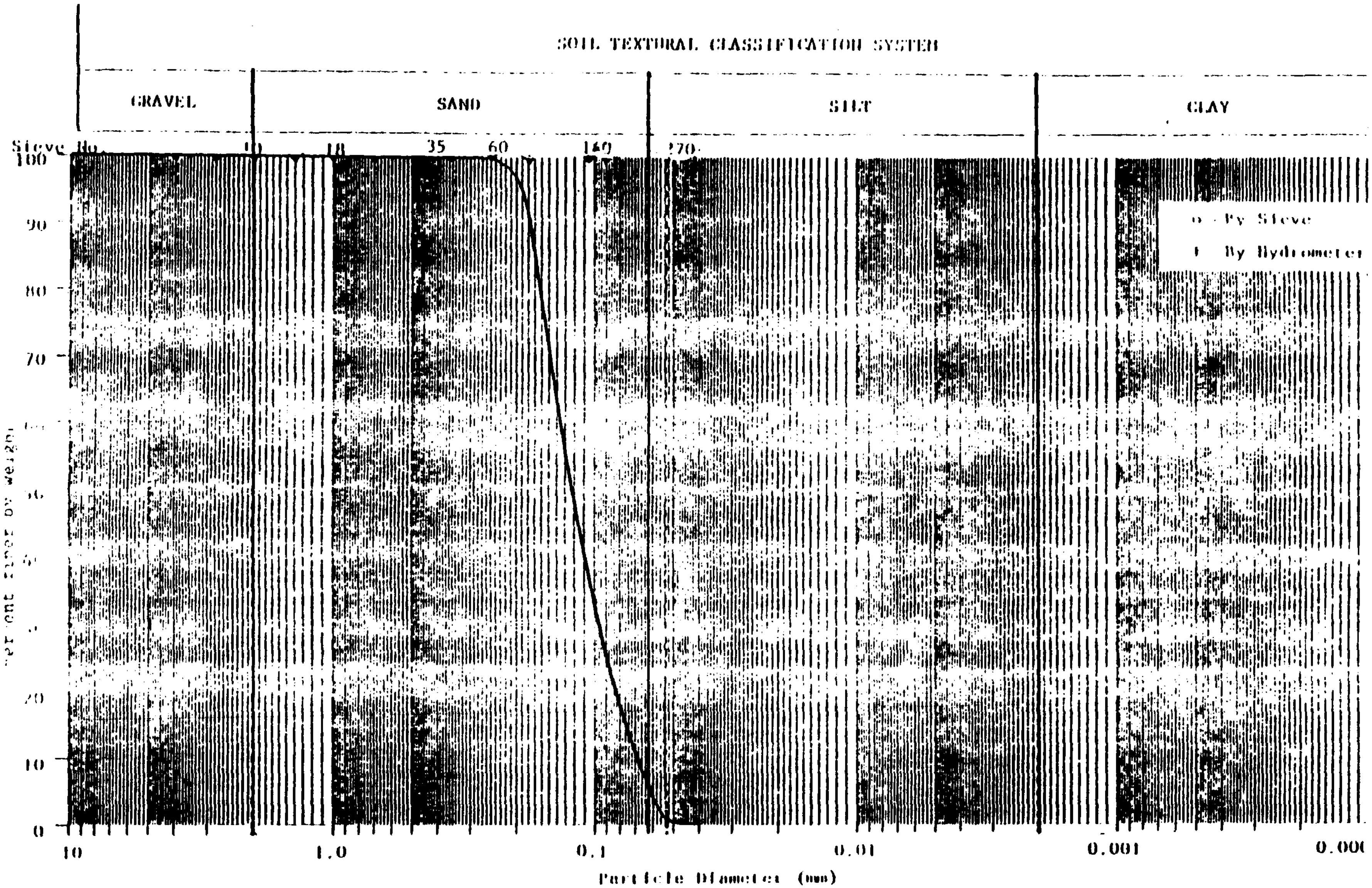
permeablilty:

3.77×10^{-3} cm/sec

grain size:

sieve no.	sieve opening (mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	NA	
18	1.00	100.00	20.0	Less than 15%	of the sample
35	.417	99.98	60.0	is finder than	.053 mm.
60	.250	99.93	240.		
140	.105	33.87	360.		
270	.053	1.17			
pan					

COMMENTS ______________



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Illinois Environmental Protection Agency---DLS

Tested By ____________

% Gravel 0 % Sand 95.0 % Silt & Clay 5%

Name: Sand

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24224

Date Collected 10/9/80 Date Received Nov.14, 1980

Division Program Code ________

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-6, 15.0-16.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

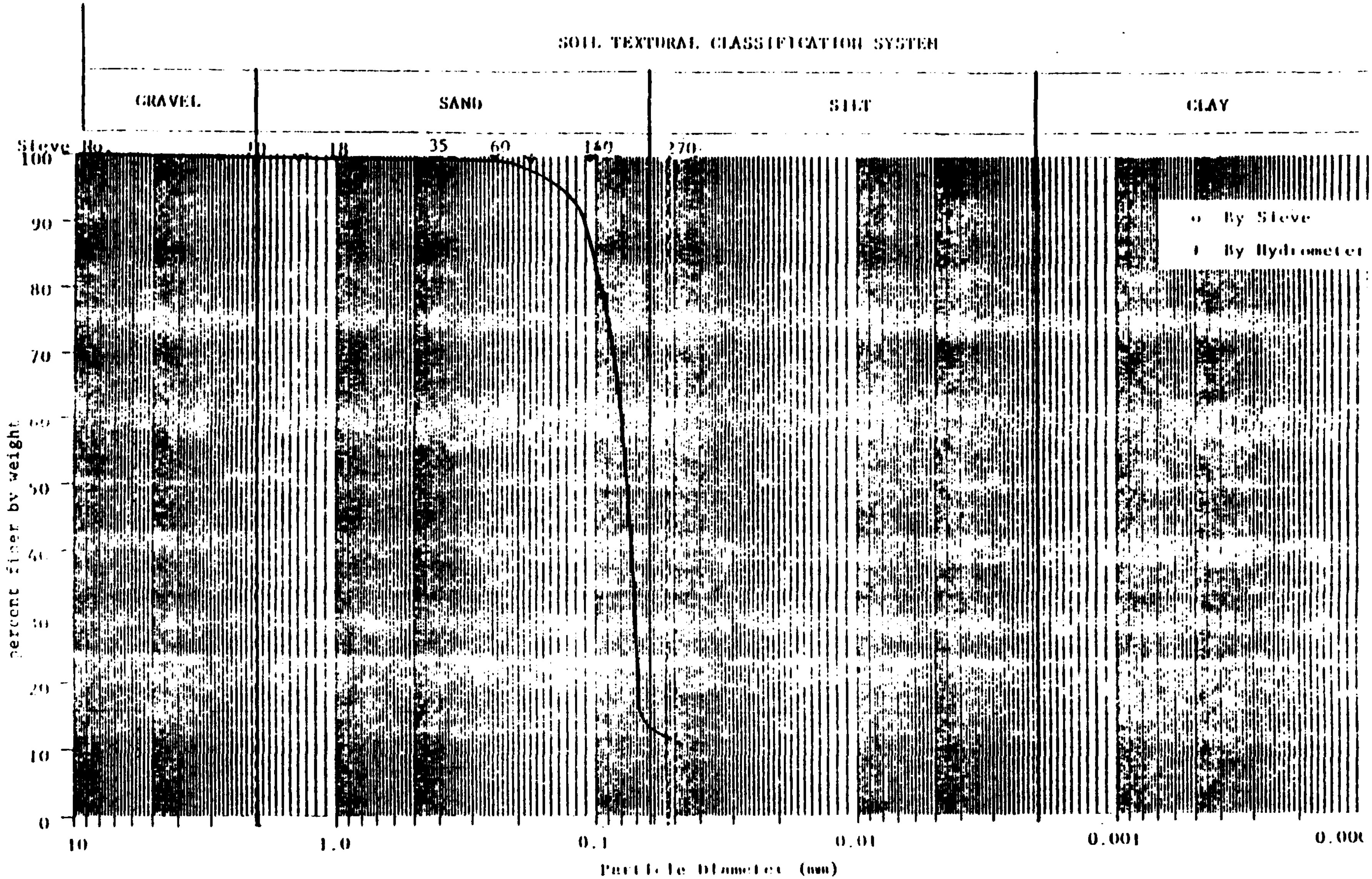
permeabiilty:

________ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.99	5.0	NA	
18	1.00	99.98	20.0	Less than 15%	of
35	.417	99.97	60.0	sample finer	than
60	.250	99.90	240.	.053 mm.	
140	.105	83.37	360.		
270	.053	10.90			
pan					

COMMENTS ____________



Sample No. (Field) ______________ Sample No. (Lab.) ______________ Date ______________

Illinois Environmental Protection Agency---DLS

Tested By ______________

% Gravel 0 % Sand 89 % Silt 11 % Clay 0 Name: Sand w/some silt

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ____________ Laboratory ID No. B 24225

Date Collected 10/9/80 Date Received Nov. 14, 1980

Division Program Code ________

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-7, 20.0-21.5

Physical Observations, Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
__ DISTURBED PERMEABILITY
__ OTHER ____________

DATE ANALYSIS COMPLETED ____________

DATE ANAYSIS REPORTED ____________

TEST RESULTS

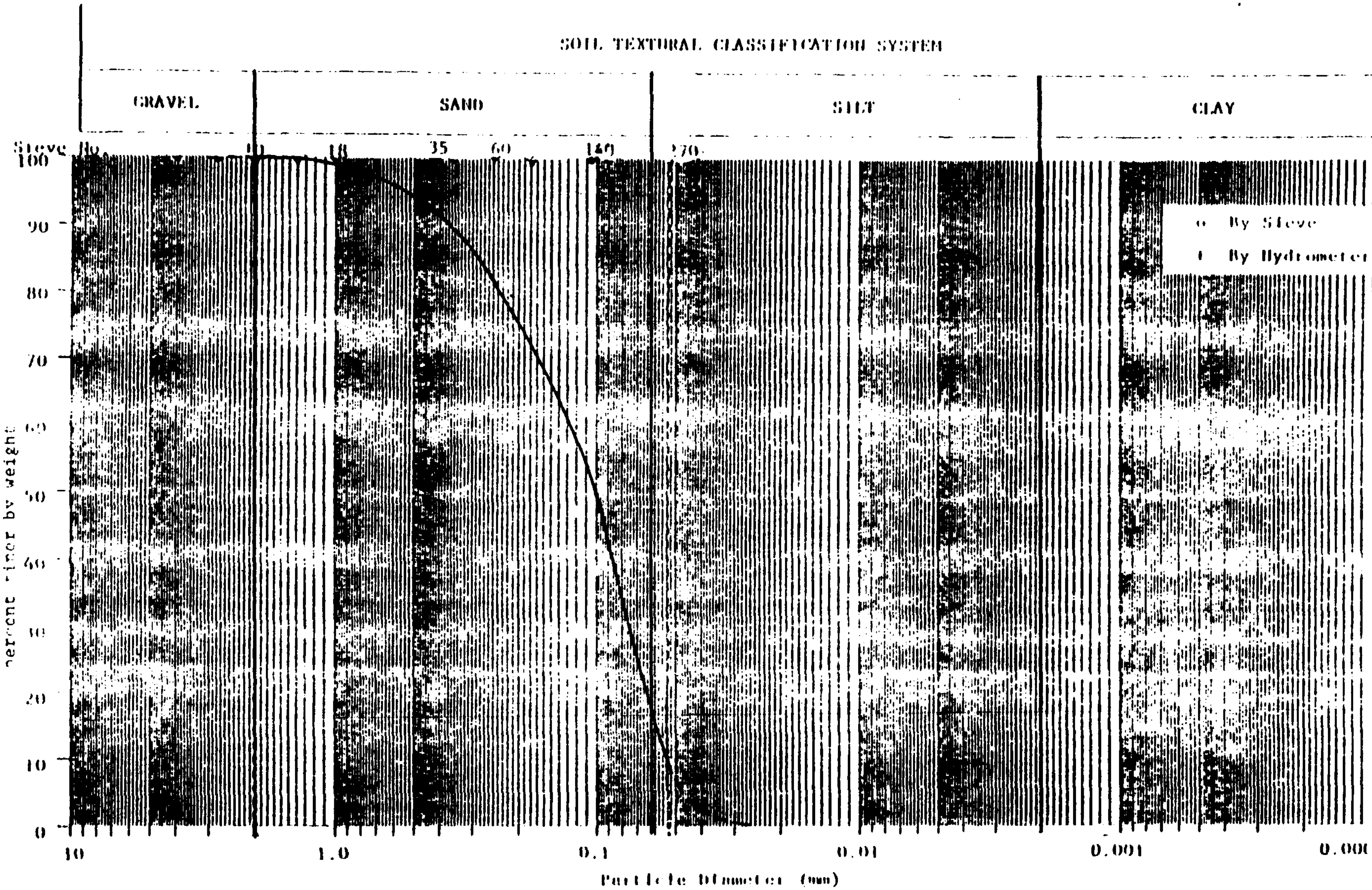
permeablilty:

________ cm/sec

grain size:

sieve no.	sieve opening (mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.74	5.0	NA	
18	1.00	98.13	20.0	Less than	15 % of
35	.417	92.98	60.0	sample finer than	
60	.250	82.38	240.	.053 mm.	
140	.105	49.52	360.		
270	.053	10.17			
pan					

COMMENTS ____________



Sample No. (Field) ________ Sample No. (Lab.) ________ Date ________

Tested By ________

Illinois Environmental Protection Agency---DLS

% Gravel .26 % Sand 82.74 % Silt 17.0 % Clay 0 Name: Sand w/some silt

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24226

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-8, 25.0-26.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

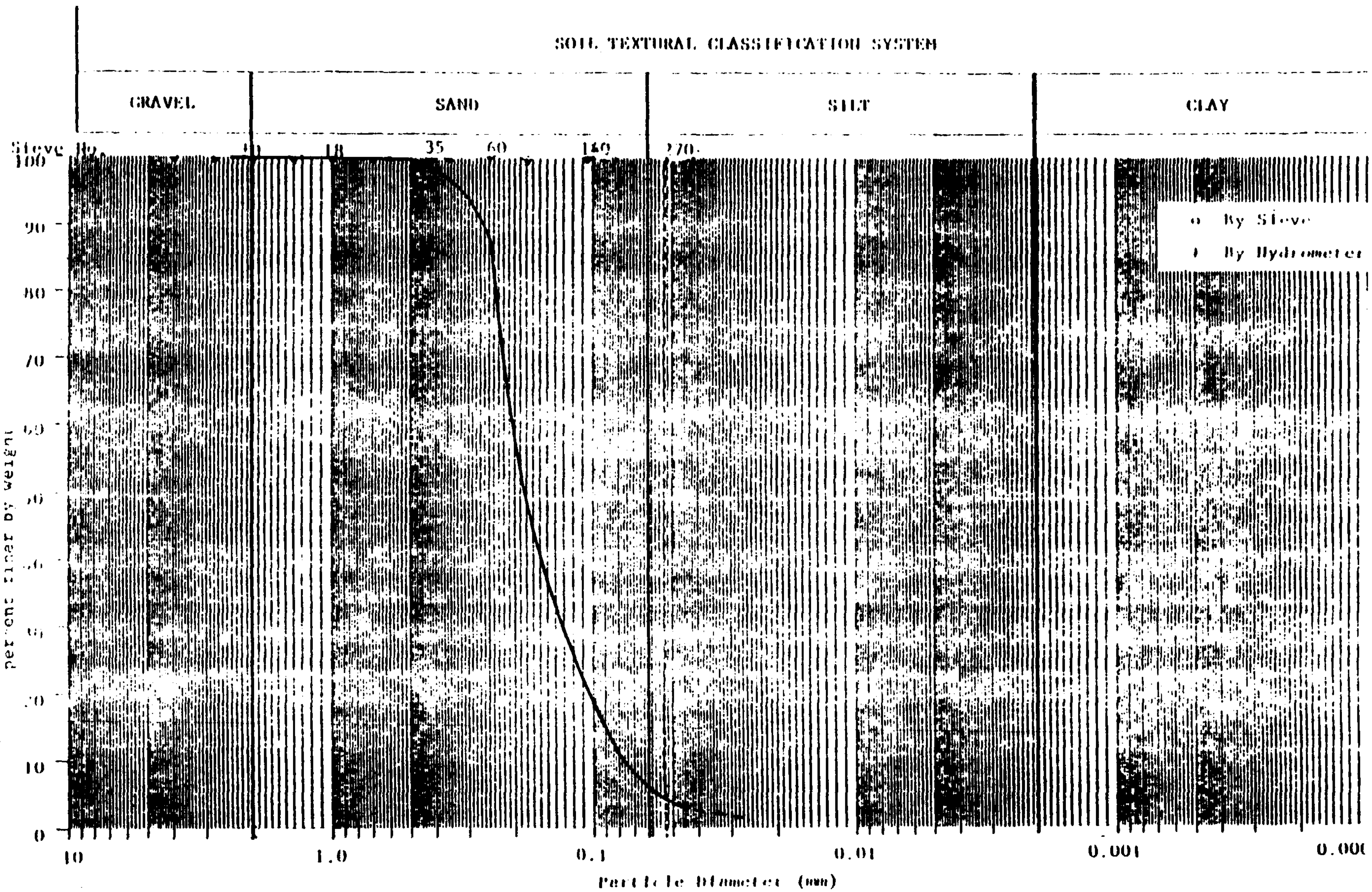
permeablilty:

________ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.87	5.0	NA	
18	1.00	99.64	20.0	Less than	15%
35	.417	97.66	60.0	of sample	finer than
60	.250	83.09	240.	.053 mm.	
140	.105	18.70	360.		
270	.053	4.51			
pan					

COMMENTS recycled paper ecology and environment



Sample No. (Field) ______________ Sample No. (Lab.) ______________ Date ______________

Tested By ______________

Illinois Environmental Protection Agency---DLS

% Gravel .13 % Sand 95.36 % Silt & Clay 4.51 Name: Sand

✓-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24229

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-10, 30.0-31.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
__ DISTURBED PERMEABILITY
__ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

permeablilty:

________ cm/sec

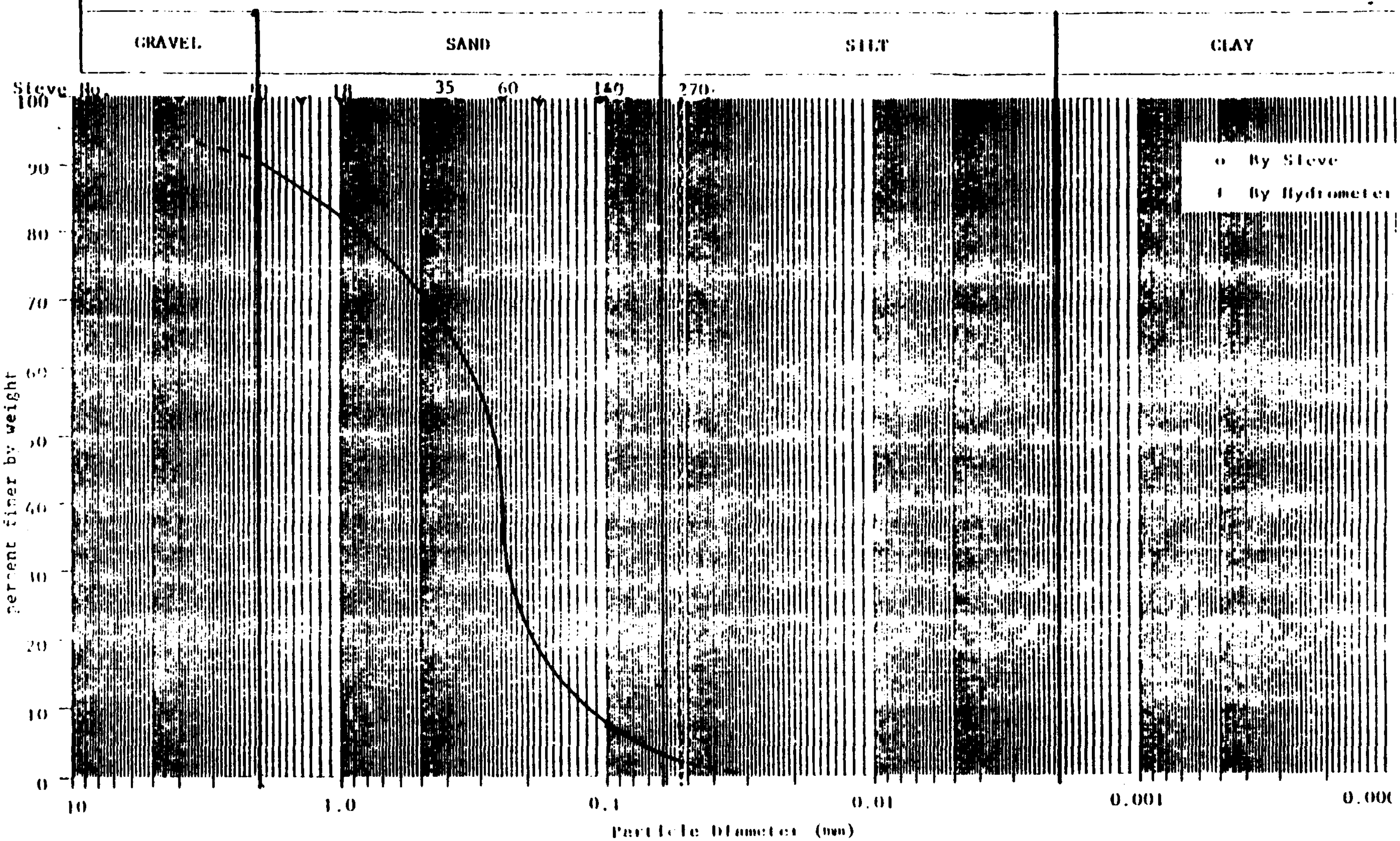
grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	90.83	5.0	NA	
18	1.00	83.98	20.0	Less than	15% of
35	.417	65.82	60.0	sample is	finer
60	.250	39.28	240.	than .053	mm.
140	.105	7.52	360.		
270	.053	3.01			
pan					

COMMENTS ______________

LPC 2? 7/80

SOIL TEXTURAL CLASSIFICATION SYSTEM



Sample No. (Field) ______ Sample No. (Lab.) ______ Date ______

Tested By ______

Illinois Environmental Protection Agency---DLS

% Gravel 9.17 % Sand 87.82 % Silt & Clay 3.01%

Name: Sand w/some gravel

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24228

Date Collected 10/9/80 Date Received Nov.14.1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-3, S-11, 35.0-36.5

Physical Observations, Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
X DISTURBED PERMEABILITY
__ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

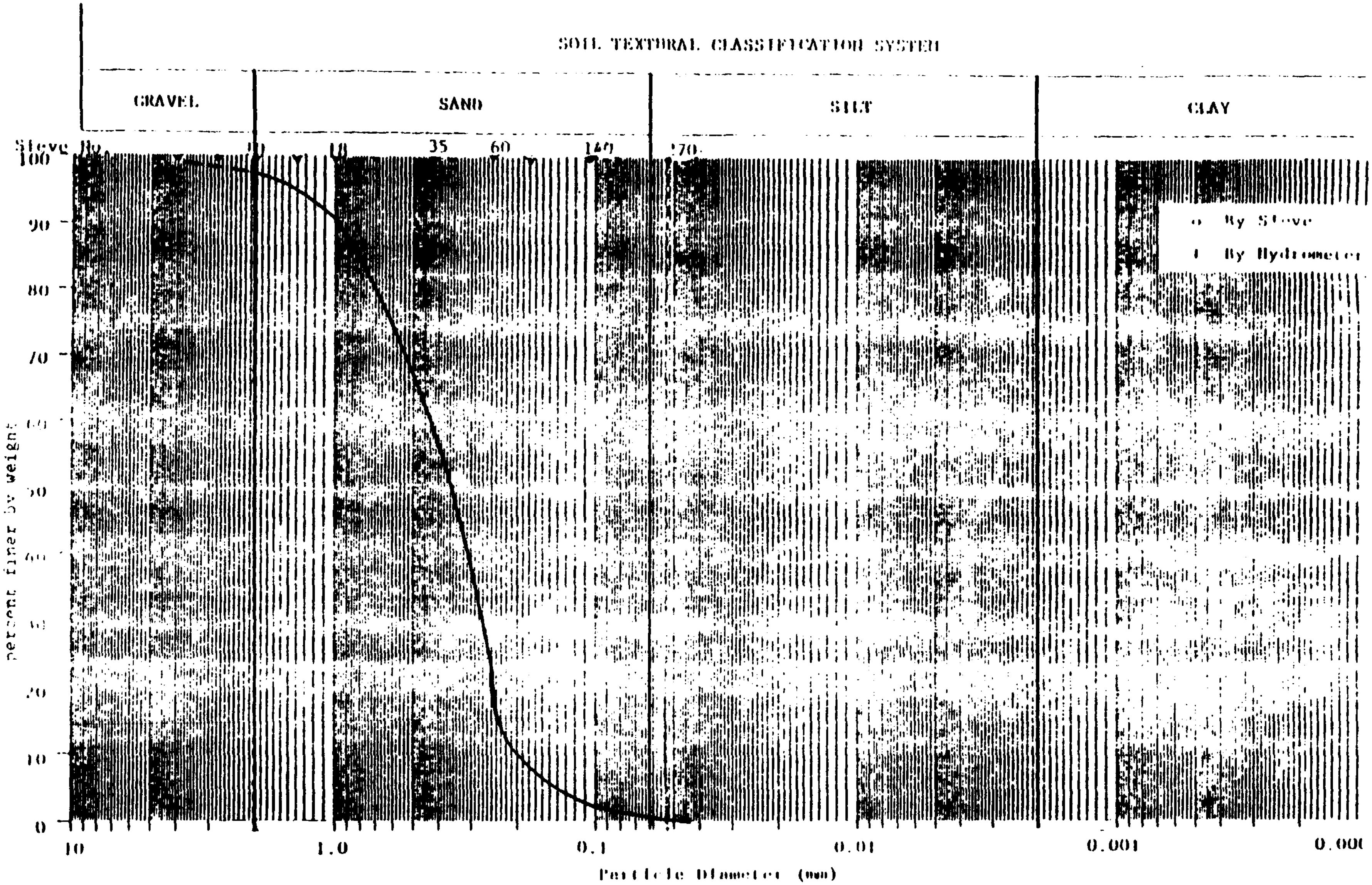
permeablilty:

4.1 X 10^{-3} cm/sec

grain size:

sieve no.	sieve opening (mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	97.39	5.0	NA	
18	1.00	90.46	20.0	Less than	15% of
35	.417	56.37	60.0	sample finer than	
60	.250	22.52	240.	.053 mm.	
140	.105	2.92	360.		
270	.053	1.24			
pan					

COMMENTS



Sample No. (Field) ________ Sample No. (Lab.) ________ Date ________

Tested By ________

Illinois Environmental Protection Agency---DLS

% Gravel 2.61 % Sand 96.15 % Silt & Clay 1.24 Name: Sand

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______ Laboratory ID No. B 24209

Date Collected 10/9/80 Date Received Nov.14.1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)

B-4, S-1, 0.0-2.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
__ UNDISTURBED PERMEABILITY
__ DISTURBED PERMEABILITY
__ OTHER ______

DATE ANALYSIS COMPLETED ______

DATE ANAYSIS REPORTED ______

TEST RESULTS

permeablility:

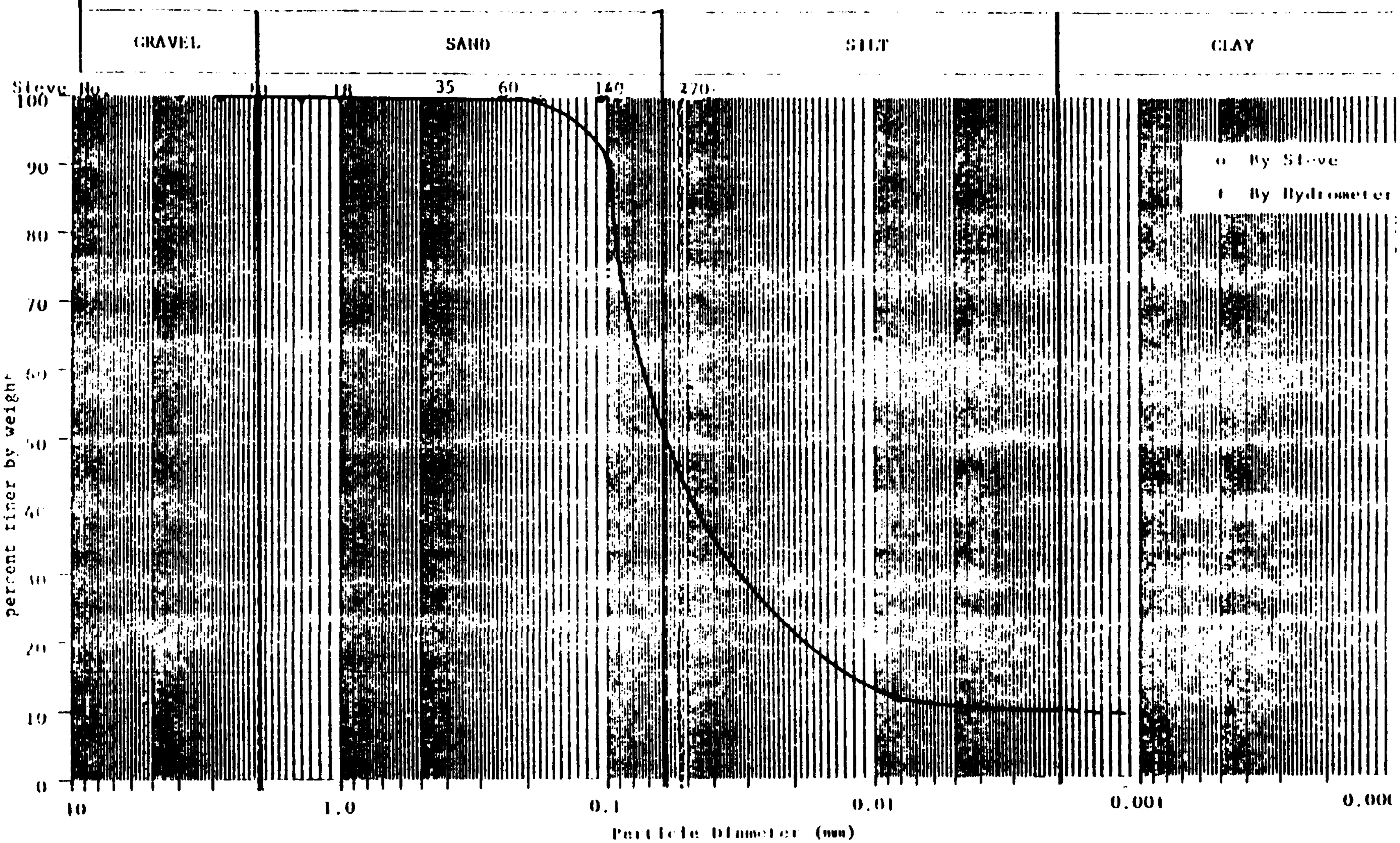
______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0 *	0.0140	15.7
18	1.00	100.00	20.0	0.0086	12.3
35	.417	99.96	60.0	0.0049	10.9
60	.250	99.51	240.	0.0023	9.5
140	.105	90.33	360.	0.0020	9.5
270	.053	44.40			
pan					

COMMENTS * 7.75 m

SOIL TEXTURAL CLASSIFICATION SYSTEM



Sample No. (Field) ________________ Sample No. (Lab.) ________________ Date ________

Illinois Environmental Protection Agency---DLS Tested By ________

% Gravel 0 % Sand 58 % Silt 32.5 % Clay 9.5 Name: Silty Sand w/some clay

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24210

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-4, S-2, 2.5-4.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

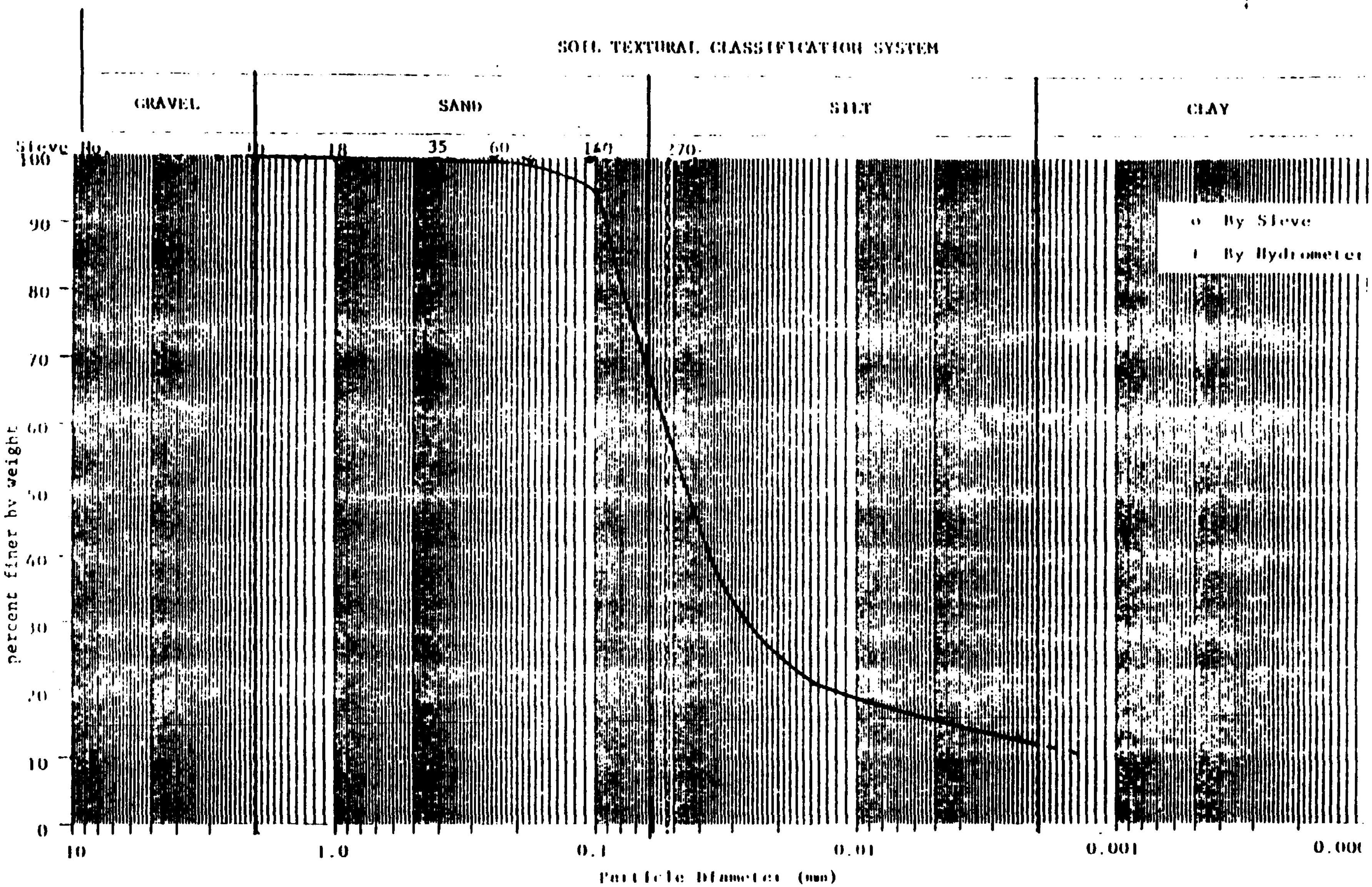
permeability:

______ cm/sec

grain size:

sieve no.	sieve opening (mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0148	21.91
18	1.00	99.98	20.0	.0087	18.10
35	.417	99.92	60.0	.0049	15.24
60	.250	99.82	240.	.0023	13.33
140	.105	94.87	360.	.0020	12.39
270	.053	59.90			
pan					

COMMENTS ______________



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Tested By ____________

Illinois Environmental Protection Agency---DLS

% Gravel 0 % Sand 33 % Silt 64.61 % Clay 12.39 Name: Sandy Silt w/some clay

V-78(

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______________ Laboratory ID No. B 24211

Date Collected 10/9/80 Date Received Nov.14.1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-4, S-3, 5.0-6.5

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ______________

DATE ANALYSIS COMPLETED ______________

DATE ANAYSIS REPORTED ______________

TEST RESULTS

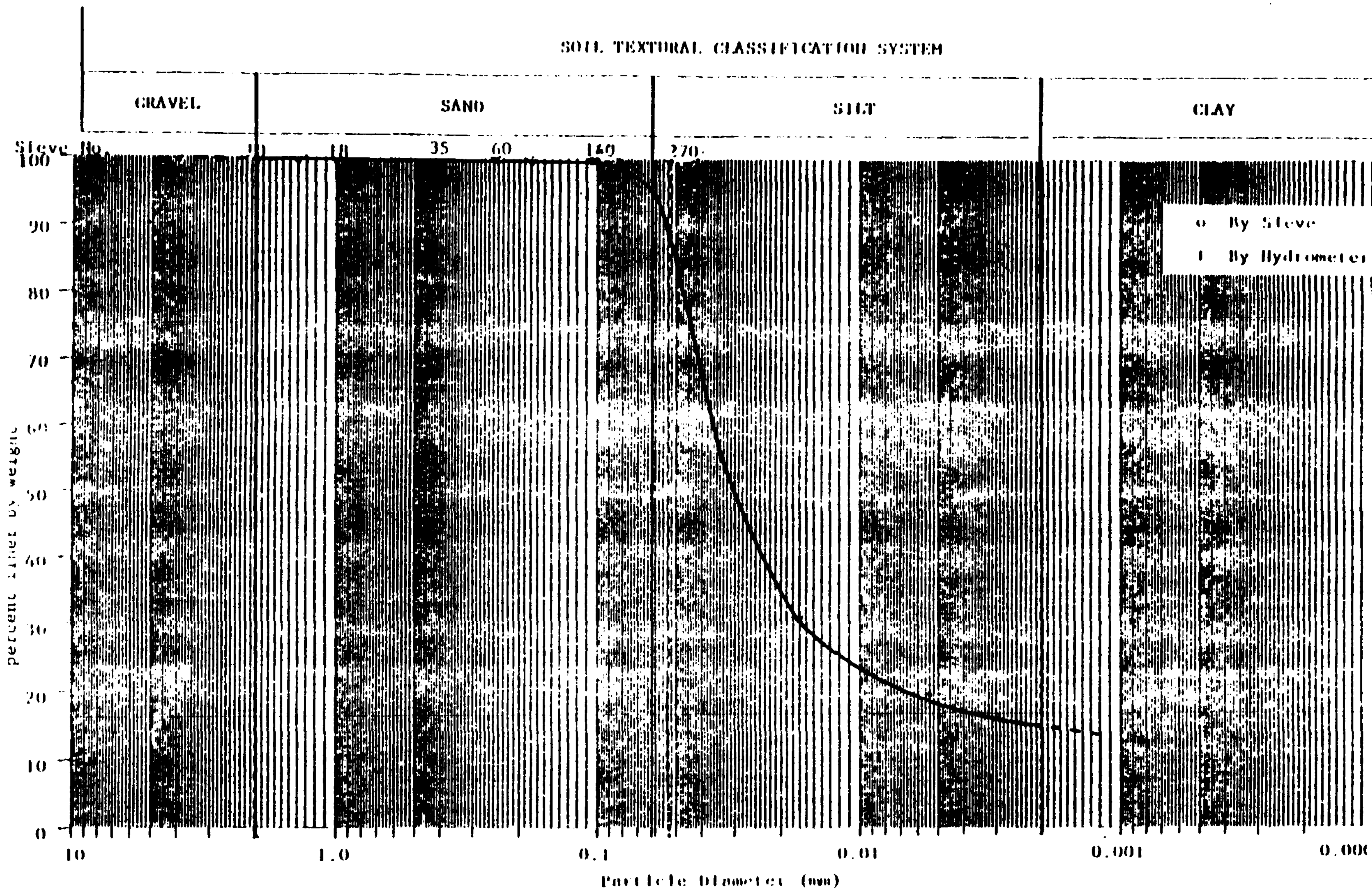
permeablilty:

______ cm/sec

grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	100.00	5.0	.0171	30.73
18	1.00	99.96	20.0	.0095	22.90
35	.417	99.88	60.0	.0054	19.88
60	.250	99.82	240.	.0025	16.87
140	.105	98.72	360.	.0021	15.67
270	.053	87.98			
pan					

COMMENTS ______________________________



Sample No. (Field) ______________ Sample No. (Lab.) ______________ Date ______________

Illinois Environmental Protection Agency---DLS

Tested By ______

% Gravel 0 % Sand 6 % Silt 88.33 % Clay 15.67 Name: Clayey Silt w/some sand

V-78

ILLINIOS ENVIRONMENTAL PROTECTION AGENCY - Division of Land/Noise Pollution

Time Collected ______ Laboratory ID No. B 24214

Date Collected 10/9/80 Date Received Nov.14,1980

Division Program Code ______

County	File Heading	File Number
St. Clair	Dead Creek/Cahokia	

Source of Sample (boring number, sample number, depth interval in feet)
B-4, S-6, 12.5-14.0

Physical Observations,Remarks

TESTS REQUESTED

X HYDROMETER SIZE ANALYSIS
X SIEVE SIZE ANALYSIS
___ UNDISTURBED PERMEABILITY
___ DISTURBED PERMEABILITY
___ OTHER ______

DATE ANALYSIS COMPLETED ______

DATE ANAYSIS REPORTED ______

TEST RESULTS

permeablilty:

______ cm/sec

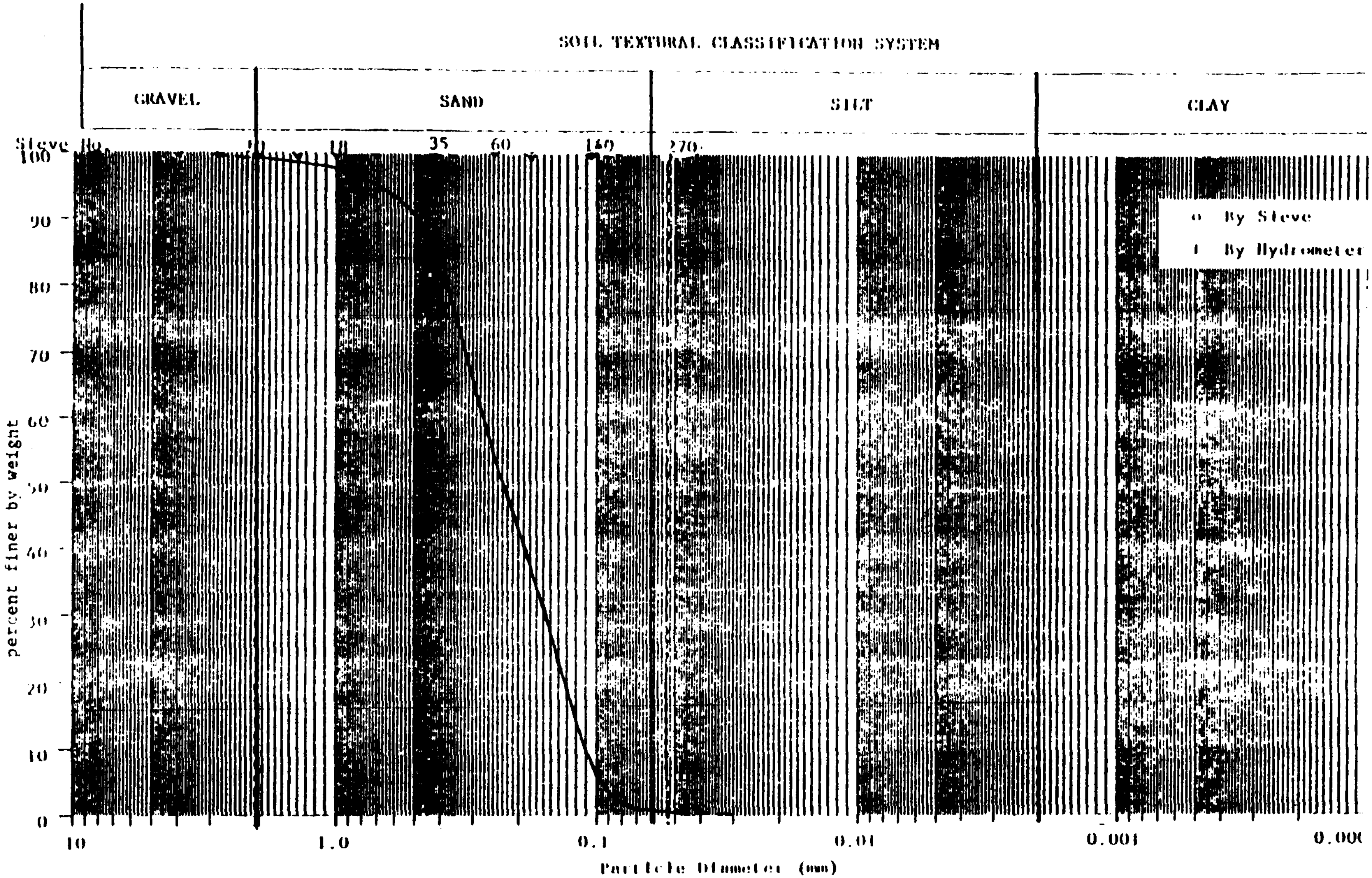
grain size:

sieve no.	sieve opening(mm)	P, percent of sample finer	time (min)	particle size, D(mm)	P, % remaining in solution
10	2.00	99.46	5.0	Less than	NA
18	1.00	97.84	20.0	15% of	NA
35	.417	83.48	60.0	sample finer	NA
60	.250	48.14	240.	than .053 mm.	NA
140	.105	5.79	360.		NA
270	.053	1.66			
pan					

COMMENTS ______

recycled paper ecology and environment

LPC 25 7/80



Sample No. (Field) ____________ Sample No. (Lab.) ____________ Date ____________

Tested By ____________

Illinois Environmental Protection Agency---DLS

% Gravel 0.54 % Sand 97.8 % Silt& Clay 1.66

Name: Sand

V-78

Appendix 3 - Geophysical Equipment

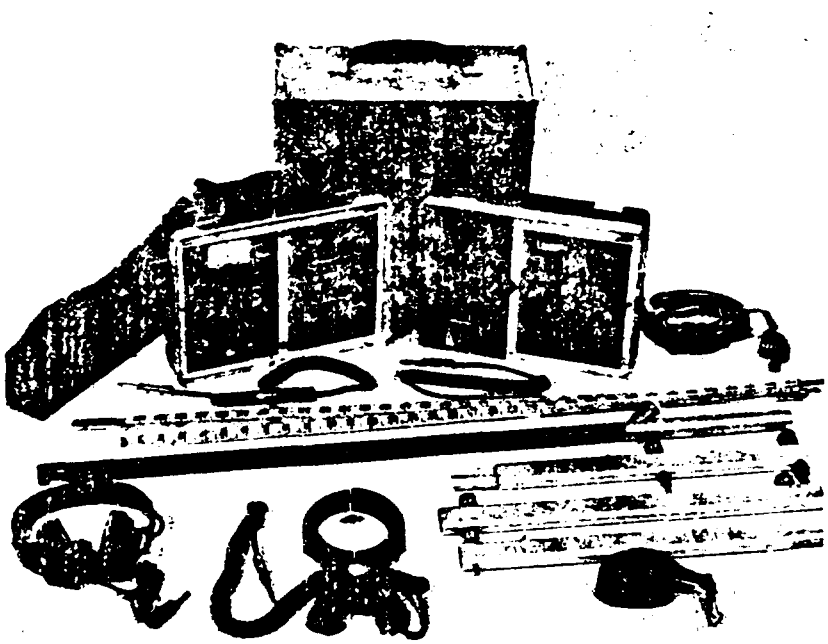
Equipment Specifications

Two forms of seismic equipment were tried in the study area. A Geospace GT2B 12 channel portable refraction unit, utilizing plastic explosives, and a Bison 1570A signal enhancement seismic unit were used in an attempt to locate the position, size, and depth of the former sand pits in the area. Neither unit was successful as there was too much interference in the area caused by industry and traffic.

Information pertaining to the metal detector used appears in Figure A-2.

FISHER'S M-Scope Model TW-5

PIPE and CABLE LOCATOR



FEATURES

- Auto-Sensitivity Meter
- Discriminator circuit eliminates outside interference, such as 60-Hz signals
- Three operating modes: Inductive Location, Inductive Tracing, and Conductive Tracing
- Wide scope of applications: the TW-5 locates, traces, pinpoints, and determines depth
- Easy and accurate depth measurement thanks to 45° bull's-eye level built into the control housing; even greater accuracy using the tracer probe
- All solid-state circuitry
- Field-proven reliability
- Moisture-resistant
- Built-in Loudspeaker
- 5-Year Limited Gold Seal Warranty

fisher M-SCOPE

FRL, INC a subsidiary of Cohu, Inc.

Figure A-2. Metal detector specifications

Draft

IL-3020-01172

APPENDIX B

DRAFT SAMPLING PLAN FOR THE DEAD CREEK PROJECT

February 1986

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY
DIVISION OF LAND POLLUTION
2200 CHURCHHILL ROAD
SPRINGFIELD, ILLINOIS, 62706

Draft

TABLE OF CONTENTS

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Table of Contents (Cont.)

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LIST OF ILLUSTRATIONS

LIST OF TABLES

1. SCOPE/OBJECTIVES

This sampling plan has been prepared by Ecology and Environment, Inc., (E & E) for the Illinois Environmental Protection Agency (IEPA) for the Remedial Investigation (RI) at the Dead Creek Project in the towns of Sauget and Cahokia, Illinois. The objective of the sampling is to define the nature and extent of contamination of the Dead Creek Project area by investigating air quality, surface and subsurface soils, and groundwater, as well as surface water and sediments in Dead Creek. Sampling will be conducted in 18 areas: six sectors of Dead Creek, designated A through F, and 12 sites, designated G through R. The analytical data resulting from the RI will be used to prepare a Feasibility Study (FS) to determine if remedial actions are necessary and what level and types of actions are required to mitigate the contamination.

The purpose of the surface soil sampling is to:

- Define the overall extent of surface contamination;
- Describe and categorize contaminant types;
- Locate and define "hot spot" areas of contamination; and
- Provide data to estimate quantities of contaminated soil which require remedial action.

The purpose of the subsurface soil sampling is to:

- Locate and investigate subsurface areas containing hazardous materials, including areas which may have received bulk solid or liquid wastes in addition to containerized wastes;

- Identify and categorize waste materials which are detected; and

- Estimate quantities of waste requiring remedial activities.

The purpose of the groundwater sampling, which will involve the sampling of both existing and newly installed wells, is to:

- Provide groundwater quality data;
- Identify contaminants; and
- Determine the extent and location of contaminated plume(s).

The purpose of the surface water and sediment sampling is to:

- Assist in defining surface water drainage patterns;

- Assist in determining rates of runoff and infiltration in the area;

- Determine types of contaminants in surface water and sediments and possible sources, including:

  - Surface runoff,
  - Solubilization of substrate contaminants, and
  - Groundwater, and

- Provide data to estimate quantity of water and sediment which requires remediation.

In addition to the above activities, soil gas surveys and air quality investigations will be conducted as necessary. The purpose of the soil gas survey is to aid in the identification and definition of any contaminated plume or contaminant "hot spots." Air quality investigations will aid in the characterization of air contaminants and will include both ambient air characterization and investigation of point source air releases.

2. SAMPLING LOCATIONS

Samples to be collected from the Dead Creek Project sites include:

- Surface soil samples;
- Subsurface soil samples (from borings);
- Groundwater samples; and
- Surface water/sediment samples.

In addition, air quality investigations will be conducted on a routine basis during on-site work. Soil gas measurements will be taken as necessary, but will not exceed 96 specific locations.

Table 2-1 provides a summary of the number of samples to be collected for each of the various sample media, at the various sites. The site locations are shown on Figure 2-1. Individual site maps are presented in Section 10, at the end of this document.

2.1 AIR INVESTIGATION

The air investigation will consist of screening with an Organic Vapor Analyzer (OVA) and the HNu Photoionizer (HNu) when deemed necessary to locate "hot spot" off-gassing and point source releases at random points on each of the sites. Initially, an air survey will be conducted on-site prior to the start of operations to establish a baseline. Then, air quality investigations will be conducted when on-site work, such as drilling, soil gas surveys, soil sampling, etc., is in progress. An OVA will be utilized to determine the concentration

Draft

Table 2-1

DEAD CREEK PROJECT SAMPLING FOR VARIOUS MEDIA

Sample Medium	Site	Sample Matrix	Number of Samples	Comments
Surface water/sediment	A	Water	3	Grab and composite
" "	B	"	3	" "
" "	C	Water/sediment	2/2	" "
" "	D	" "	1/2	" "
" "	E	" "	3/10	" "
" "	F	" "	4/10	" "
" "	M	" "	2/3	" "
" "	Field QC samples*	" "	5/6	" "
Surface soil	G	Soil	40	Grid (50 foot)
" "	H	"	5	Random
" "	I	"	32	Grid (100 foot)
" "	J	"	5	Random
" "	N	"	3	"
	O	"	10	Grid (100 foot)
" "	Field QC samples*	"	15	Random
Subsurface soil	G	Soil	10	Composite
" "	H	"	5	"
" "	I	"	15	"
" "	J	"	5	"
" "	K	"	3	"
" "	L	"	4	"
" "	N	"	2	"
" "	Field QC samples*	"	12	"
Groundwater	Existing monitoring wells	Water	12**	Assigned wells
"	Existing residential wells	"	5	" "
"	New monitoring wells	"	20	" "
"	Field QC samples for wells*	"	8	
Total Samples			199 soil/sediment 68 water 96 soil gas***	

*Field QC samples include one duplicate per 10 samples and one blank per day or per shipment if more than one shipment is made per day.

**Actual number of samples to be determined. Only 8 of 12 existing wells have been located. All wells need to be reconstructed prior to sampling.

***See Section 2.6 Soil Gas Survey for specific locations.

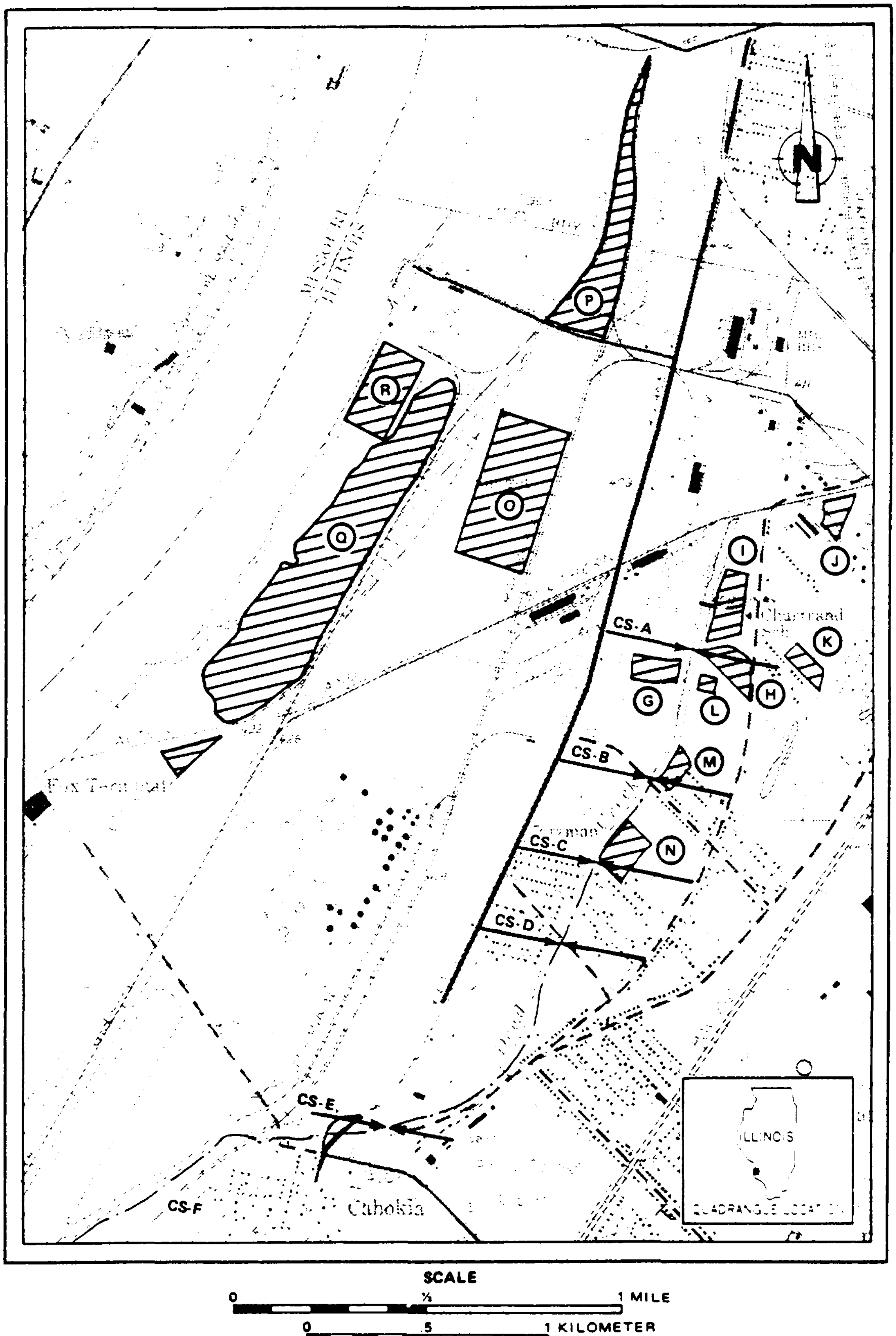

Figure 2–1 DEAD CREEK PROJECT AREA SITE LOCATION MAP

of organic vapors present in the breathing zone and in the soil. Parameter air sampling using the OVA will be performed once every two hours down range from the work station to determine if any volatile organics are leaving the site at elevated levels.

2.2 SURFACE SOIL SAMPLING

Surface soil sampling will be performed in site areas G, H, I, J, N, and O. Sites H, J, and N will be sampled at random locations to be determined in the field (e.g., samples will be taken in areas where stains or other signs of contamination are present). Some samples may be field composited depending upon conditions at the time of sampling; field screening measurements will be obtained using an OVA. A total of 23 samples will be analyzed from these three sites.

Sites G and I have been designated for grid sampling, per the IEPA scope of work. In addition, surface sampling, utilizing a 100-foot grid system, is proposed for Site O in order to characterize the wastes present in the former treatment plant lagoons. Data from the grid sampling will be plotted and contoured on a site base map. Initially, a grid will be staked out on the surface using common surveying and measuring techniques. Site G will be sampled at 50-foot intervals resulting in 40 samples and Sites I and O will be sampled at 100-foot intervals resulting in 42 samples. Reference points will be noted in order to accurately map the soil locations for contour maps. Compositing will be used at each surface sampling location to ensure that a representative sample is obtained. Selected samples will be field-screened with an OVA and HNu when necessary.

A total of 110 surface soil samples will be collected and analyzed for all Hazardous Substance List (HSL) compounds as well as metals and cyanide. The HSL compounds include volatiles, semi-volatile (base/neutral and acid extractable) compounds, and pesticides/PCBs. Ten soil samples will be analyzed for dioxin at the direction of IEPA. The 110 samples include 10% quality control samples, consisting of one duplicate per 10 samples and one blank per day. Surface soil blanks used to determine background levels will be collected in an area of similar soil type deemed not to have been subjected to disposal activities.

2.3 SUBSURFACE SOIL SAMPLING

Subsurface soil sampling will be performed on seven sites areas G, H, I, J, K, L, and N. The proposed sampling method involves the use of continuous split-spoon sampling to the maximum depth of each boring. The subsurface samples will be collected using 5-foot split spoons. However, if field conditions prevent use of continuous sampling, 1.5-foot split spoons will be used to collect samples on an interval basis.

At each borehole, individual samples will be placed in sample jars and sealed. Compositing will be performed on a designated area at the hotline. Composite samples will be prepared in the following manner:

- Each interval to be composited will be thoroughly mixed in its sample container.

- One tablespoon of material from each depth interval to be composited will be placed into a composite container in succession until the container is filled.

Sample locations will be chosen based on additional review of results of the geophysical study performed at sites G, H, and L, and on re-examination of historical aerial photography of sites I, J, K, and N. Split-spoon samples recovered will be screened with an OVA, and an HNu when necessary. Due to the limited number of samples allotted for subsurface sampling, samples will be composited.

A total of 56 subsurface soil samples will be collected and analyzed for all HSL compounds, metals, and cyanide. The 56 samples will include 10% quality control samples, consisting of one duplicate per 10 samples and one blank per day. Soil sample blanks will be collected in an area deemed not to have been subjected to disposal activities. These samples will be used to determine the background level of contaminants in the area soils.

The following briefly describes the subsurface sampling at each of the seven sites.

Site G

Ten subsurface samples will be collected from Site G. Review of geophysical data indicates that the entire area lying between Queeny Avenue and a cultivated field approximately 300 feet south of Queeny Avenue has been backfilled indicating large amounts of metal pieces are strewn throughout the area. In addition, numerous drums in various stages of deterioration have been noted on the surface.

Eight borings will be drilled to a maximum depth of 20 feet. Borings will be continuously sampled unless otherwise determined in the field. A composite will be made of the samples from each boring. Ten composite samples will be collected for analysis. Field screening using an OVA and an HNu when necessary will be conducted.

Site H

Five composite subsurface samples will be collected at Site H. Review of geophysical data indicates that at least two and possibly three separate areas exist that may contain drummed wastes. Initially, five borings will be drilled to a maximum depth of 50 feet. Two additional borings may be drilled near the perimeters of identified anomalous areas or where elevated OVA readings are noted. Borings will be continuously sampled unless otherwise determined in the field. Samples will be field-screened using an OVA and an HNu when deemed necessary and a composite will be made of the samples from each boring.

Site I

Fifteen composite subsurface soil samples will be collected at Site I. Three borings will be drilled in the northern half of the site and six will be drilled in the southern half of the filled area. Maximum depth of the borings will be 40 feet. Borings may be shallower, depending upon visual inspection of the sample for staining and other field conditions. Final boring locations will be chosen based upon re-examination of historical aerial photos, additional review of existing file data, and defining the location of any buried utilities. Continuous samples will be collected, unless field conditions prevent such sampling. A composite will be made of the samples from each boring.

Site J

Five composite subsurface soil samples will be collected at Site J. Five borings will be drilled to a maximum depth of 20 feet, unless field conditions prevent drilling to this depth. Borings will be continuously sampled, unless field conditions prevent it. A composite will be made of the samples from each boring. Samples will be field-screened with an OVA and HNu when deemed necessary.

Site K

Three composite subsurface soil samples will be collected from Site K. Three borings will be drilled to a maximum depth of 30 feet, unless field conditions prevent drilling to this depth. Final boring locations will be determined based upon locating buried utilities and defining property ownership. Borings will be continuously sampled, unless field conditions prevent it. A composite will be made of the samples from each boring. Samples will be screened in the field using an OVA and HNu when deemed necessary.

Site L

Four composite subsurface soil samples will be collected from Site L. The geophysical investigation indicates isolated magnetic anomalies between the stored equipment and the area to the southeast of the former lagoon which is suspected to have been used for disposal of liquids. The electromagnetic (EM) conductivity study showed a high intensity anomaly to the southeast of this same area. Borings will be continuously sampled, unless field conditions prevent it. Total maximum depth of the borings will be 20 feet, unless field conditions prevent drilling to this depth. Samples will be field-screened using an OVA or HNu when necessary. A composite will be made of the samples from each boring.

Site N

Two composite subsurface samples will be collected from Site N. Two borings will be drilled to a maximum of 50 feet, unless field conditions prevent drilling to this depth. Boring locations will be determined after field inspection. Historical aerial photographs suggest the placement of one boring each in the southeast and the northwest portions of the filled area. Continuous samples will be collected to completion depth. A composite will be made of the samples from each boring. Samples will be screened in the field with an OVA or an HNu when determined necessary.

2.4 GROUNDWATER SAMPLING

The proposed scope of work calls for the collection of groundwater samples from 12 existing monitoring wells, 5 existing residential wells, and 20 new monitoring wells (to be installed). However, only 8 of the 12 monitoring wells supposedly in existence have been located, and these 8 wells consist of hacksaw-slotted glue-joint PVC casing and will have to be reconstructed prior to sampling.

Measurements of groundwater levels and total well depth will be recorded before these samples are collected. All recorded data will be used to define groundwater level fluctuation and flow patterns in the area. Groundwater contour maps will also be generated from the hydrologic data. Field measurements of pH, temperature, and conductivity will be taken during sampling.

At least 10% of the samples will be collected in duplicate as field quality control samples. Field blanks will be furnished at one per day or one per shipment if more than one shipment is made in a day. A total of 45 samples (pending a determination by IEPA concerning the existing wells), including quality control samples, will be collected and analyzed for all HSL compounds, metals, and cyanide.

2.5 SURFACE WATER/SEDIMENT SAMPLING

Twenty-three surface water and 33 water sediment samples will be collected from creek sectors A, B, C, D, E, and F, as well as Site M. One surface water sample and one sediment sample will be collected at a point considered downstream from all sites. Composite samples may be collected for both surface water and sediments within each site location. All composite or grab samples will be designated as such. All surface water and water sediment samples will be analyzed for HSL compounds, metals, and cyanide. All surface water samples will be field tested for pH, temperature, and conductivity. The following describes the sample locations at each site.

Creek Sector A

Three composite water samples will be collected from Creek Sector A. Samples will be collected from different depths from upstream, midstream, and downstream profiles within the creek; composites will be made for each profile.

Creek Sector B

Three composite water samples will be collected from Creek Sector B. The sampling will be performed as described for Creek Sector A.

Creek Sector C

Two water samples will be collected from different depths from upstream and downstream profiles in Creek Sector C, and a composite will be made for each profile. Sediment samples will also be collected from 1-foot cores from three locations on each profile, and a composite made for each profile.

Creek Sector D

One water sample will be collected from a downstream location in Creek Sector D. Sampling will be performed as described for Creek Sector C. Two sediment samples will be collected from upstream and downstream profiles, as described for Creek Sector C.

Creek Sector E

Three water samples and 10 sediment samples will be collected from Creek Sector E. Composites will be made from samples from different depths of downstream, midstream, and upstream profiles. Four composite sediment samples will be collected from downstream, upstream, and two midstream profiles. Additional sediment samples will be collected where major surface drainage or effluent discharge pipes enter the creek.

Creek Sector F

Four water samples and 10 sediment samples will be collected from Creek Sector F. Currently, IEPA wishes to defer sampling this section pending results from the sampling at Creek Sector E. If Creek Sector E shows contaminants in the downstream area, then sampling will be scheduled in Creek Sector F. If Creek Sector F is sampled, it will be done in the same manner as in Creek Sector E.

Site M

Two water samples and three sediment samples will be collected from Site M. This site is an abandoned materials pit located adjacent to the creek. Temperature, conductivity, and pH will be measured in the field. Two composite water samples will be collected using a Kemmerer bottle or negative/positive pressure sampling device. Three random sediment samples will be collected from the northwest, southwest, and east-central portions of the pond. Sediment sampling will be conducted using a Peterson steel dredge. This sampling may require a boat.

2.6 SOIL GAS SURVEY

The areas to be evaluated during the soil gas survey were selected by the IEPA. The survey will be conducted at 96 locations, in the sequence presented below. The number of locations to be sampled during each sequence is indicated in parentheses.

- Dead Creek area south of Queeny Avenue (Sites H and L on the east side of the Creek and Site G on the west side of the creek) (32 locations);
- Site M (6 locations);
- Site N (12 locations);
- Along the banks of sections of Dead Creek (Sectors A through E) (10 locations);
- Site K (6 locations);
- Site J (10 locations); and
- Site I (20 locations).

3. SAMPLING PROCEDURES

3.1 AIR INVESTIGATION

The air investigation will include:

- Surveying of sites for "hot spot" off-gassing;
- Identifying and quantifying air releases; and
- Determining background contaminant levels.

The air investigation will include two phases: preliminary source identification and remedial air investigation.

A meteorological station will be set up prior to on-site work to provide baseline data concerning wind direction and speed. The information will be used to determine locations for perimeter monitoring. A baseline volatile organic vapor survey will be conducted on the site prior to any sampling effort to identify areas where potential air problems may exist.

Each site then will be surveyed with an HNu, OVA, or other monitoring equipment. Instrument readings will be recorded for subsequent review and analysis. During this baseline survey, the presence and location of any staining on the ground or exposed waste materials will also be noted and recorded in the field logbooks. An assessment of the vegetative cover on each site will also be made to assist in the planning of additional particulate studies. OVA and HNu values will be recorded for further evaluation.

To achieve the optimum level for the presence of volatile organics in the air, the baseline volatile organic vapor survey should be conducted when ambient air conditions would provide the highest levels. Best results will occur when the air temperature exceeds 80°F and the wind speed is below five miles per hour (mph). Additionally, this baseline survey should be preceded by at least several days of warm weather. Upon completion of this baseline survey, the data will be reviewed with respect to historical information collected regarding waste types and disposal practices.

After all the sites have been surveyed, additional work may be scheduled for those sites demonstrating contaminant air releases. This will entail quantifying and qualifying the exact nature of contaminants being released. High-volume particulate samplers (for detecting metals and low or semi-volatile organic compound contaminants) and Tenax tube collectors (for detecting volatile contaminants) will be set up in at least one upwind and two downwind locations from each area to be investigated. Several additional stations may be distributed to identify base levels of contaminants. High-volume filters and Tenax tubes will be shipped to E & E's Analytical Services Center (ASC) for analysis.

Additional air monitoring data can be inferred from the soil gas monitoring investigation. In this study, volatile substances are traced in the vadose zone. Data from this study can be extrapolated to indicate areas of probable emission of contaminants to the air through natural volatilization.

3.2 SURFACE SOIL SAMPLING

Surface soil samples will be collected according to the procedures described below:

- Samples will be collected to a depth not to exceed 1 foot.
- Using a stainless steel scoop/trough, soil samples will be collected from the ground surface.
- The samples will be transferred to an 8-ounce wide-mouth glass container. As many scoops as necessary will be taken until the sampling bottle is filled.

- The scoop will be decontaminated between samples to avoid cross-contamination.

- Any observable physical characteristics of the soil as it is being sampled (e.g., color, odor, physical state) will be recorded.

- Selected samples will be screened in the field using an OVA. This screening process involves filling a volatile organics bottle 1/2 full with sample material and capping the bottle, then heating the bottle in a pan of water, then uncapping the bottle and inserting the OVA probe into the head space and taking a reading.

- All pertinent weather information such as air temperature, pressure, wind velocity, sky conditions, and precipitation will be recorded.

3.3 SUBSURFACE SOIL SAMPLING

Subsurface sampling will be conducted using a drill rig with a hollow stem auger, minimum diameter 4-1/4 inches. Continuous samples will be collected unless subsurface conditions prevent this. In this case, 0- to 5-foot interval split-spoon samples will be collected. A 4-inch diameter, 5-foot split-spoon sampler with a catcher at the foot is locked into the first auger flight and retrieved with hex rods through the augers. The sampler is advanced by rotating augers to the desired depth.

If field conditions prevent use of this method, a 2-inch diameter, 18-inch split-spoon will be advanced by conventional methods. This will include attachment of the sampler to an AW rod and a standard 140-pound hammer. Blow counts will be recorded at 6-inch intervals to a total sample depth of 18 inches. Borings will be drilled to specified depths mentioned in Section 2.3 unless sample screening dictates stopping at shallower depths.

As samples are retrieved, they will be screened with an OVA and the HNu if deemed necessary. Upon completion of logging the lithology, the sample will be stored in a clean 8-ounce jar. Compositing will be performed at the hotline.

All drilling and sampling equipment to be reused will be decontaminated as specified in Section 9. When samples are to be composited, mixing will be done using stainless steel containers and tools. These also will be decontaminated between uses. Where possible and appropriate, disposable equipment will be used in order to minimize cross contamination. Prior to the start of the sampling work, all drilling tools and equipment will be washed with high-pressure steam equipment and rinsed with solvent (see Section 9).

As noted above, selected samples will be field-screened using an OVA and the HNu. A preliminary survey will be also conducted by "sniffing" the sample with an OVA and the HNu immediately upon opening the sampling tube.

Upon completion of the drilling, the open hole will be backfilled with drill cuttings or grouted. Any deficit of material will be supplied using clean earthen material. When the water table is encountered while drilling or the boring goes below the fill, grout will be used to seal that portion of the boring. Grouting will be mixed and pumped from the mud pan through the hollow stem of the auger as the auger is retrieved. The hole will be filled from the top of the grout line to ground level using drill cuttings. Any excess cuttings will be drummed and disposed of in accordance with applicable regulations.

Subsurface Soil Sample Compositing

Compositing of all soil samples will include:

- Each portion from a depth interval to be composited will be thoroughly mixed in its sample container with a stainless steel tablespoon.

- The material will be chopped, mixed, and stirred until it is homogeneous.

- A stainless steel tablespoon will be used to transfer the material to a composite container. A clean stainless steel tablespoon will be dedicated to each depth interval or each borehole to be composited. One tablespoon of material from each portion to be composited will be placed into the composite container in succession until the composite container is filled.

- The composite container will then be sealed and labeled as specified in this plan (Section 7.3).

3.4 GROUNDWATER SAMPLING

Sampling of the existing monitoring wells, residential wells, and newly installed monitoring wells will consist of the following three activities:

- Measurement of depth to water level and total depth of the well (to calculate well volume),
- Evacuation of static water (purging), and
- Collection of the sample.

These activities are described below.

3.4.1 Measurement of Water Level and Well Volume

- Prior to sampling, the static water level and total depth of the well will be measured with a calibrated weighted line. Care will be taken to decontaminate equipment between each use to avoid cross contamination of wells.

- The number of linear feet of static water (difference between static water level and total depth of well) will be calculated.

- The static volume will be calculated using the formula:

$$V = Tr^2(0.163)$$

where:

V = Static volume of well in gallons;

T = Depth of water in the well, measured in feet;

r = Inside radius of well casing in inches; and

0.163 = A constant conversion factor which compensates for $\pi r^2 h$ factor for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and π (pi).

3.4.2 Purging Static Water

Before a groundwater sample is obtained, the static water must be purged to ensure that a representative groundwater sample is taken. A minimum of three static water volumes will be purged from the well prior to collecting the samples. Purging and sampling will be performed using a stainless steel or Teflon bailer. Since the water removed from the well during the purging process could contain hazardous materials, it will be containerized and not discharged on the ground.

3.4.3 Sample Collection

Sampling personnel will take precautions against cross contamination when using one sampling apparatus for a series of samples. If possible, "clean" or "background" samples will be taken first. Before and after each sample is taken, the apparatus will be decontaminated as specified. Sample collection procedures are as follows:

- A stainless steel bailer (decontaminated according to the procedures presented in Section 9) will be used to collect the groundwater samples.

- Dedicated bailers will be used for monitoring wells. Residential well samples will be collected from existing plumbing as close as possible to the pump and prior to any water softening apparatus.

- When transferring water from the bailer to sample containers, care will be taken to avoid agitating the sample, which promotes the loss of volatile constituents.

- Samples to be analyzed for metals will be filtered in the field and preserved with nitric acid prior to shipment for analysis. Filtering equipment used will be decontaminated between samples to avoid cross contamination. Field filtration requires particular skill if contamination is to be avoided.

- The temperature, pH, and specific conductivity of the water will be measured and recorded at the time of initial purging of the well, during purging, and at the time of sampling, checking for stabilization of parameters. To avoid contamination of samples, field measurements will be performed on a portion of groundwater which is not to be analyzed.

- Any observable physical characteristics of the groundwater (e.g., color, sheen, odor, turbidity,) as it is being sampled, will be recorded.

- Weather conditions at the time of sampling will be recorded (e.g., air temperature, sky condition, recent heavy rainfall, drought conditions), as will any groundwater pumping in the surrounding areas for industrial use which might affect contaminant migration.

3.5 SURFACE WATER/SEDIMENT SAMPLING

3.5.1 Surface Water Sampling

Surface water samples will be collected according to the following procedures:

- A wide-mouth glass bottle to be used for sampling will be dipped into the creek and rinsed three times and the bottle will then be dipped to collect the sample.

- The sample will be collected in such a manner as to prevent agitation of the water, which promotes the loss of volatile organics and increases the dissolved oxygen content.

- The samples will be transferred into 1/2-gallon glass bottles and 40-ml VOA bottles. The wide-mouth bottle will be refilled as many times as necessary to fill all required bottles.

- Prior to filling 800-ml plastic bottles to be used for inorganic samples, the water will be filtered. Nitric acid will be introduced into the plastic bottles to preserve the metals. Filtering equipment used will be decontaminated between samples to avoid cross contamination. Field filtration requires particular skill if contamination is to be avoided.

- The temperature, pH, and specific conductivity of the water will be measured, and current speed/volume will be recorded at the time the sample is taken.

- Any observable physical characteristics of the water (e.g., color, odor, turbidity) as it is being sampled will be recorded.

- Weather conditions at the time of sampling will be recorded, including air temperature, barometric pressure, sky conditions, recent heavy rainfalls, and wind velocity.

3.5.2 Sediment Sampling

Sediment samples will be collected from Dead Creek using a Peterson dredge or stainless steel trowels. The sampling procedure will be as follows:

- The Peterson dredge will be decontaminated as specified in Section 9.

- The dredge will be lowered into the creek sediment until sufficient resistance is encountered to release the retainer catch. The dredge will then be withdrawn from the sediments.

- The contents of the dredge will be placed in a clean stainless steel pan and composited. A composite sample of the sediment will be transferred to an 8-ounce jar.

3.6 SOIL GAS SURVEY

Soil gas analyses will be performed along a grid of 100-foot intervals covering a pre-surveyed area. Results will be compiled and plotted on a site base map. Areas with high readings will be resurveyed at 50-foot intervals. One sample will be taken outside the area of contamination to establish background levels.

Experience with soil gas monitoring has shown that the most conducive weather conditions for a successful survey are during warm, dry, low-wind conditions following several days of warm to hot weather. The survey will be planned for such conditions.

The survey will consist of three soil gas samples taken at 4, 7, and 10 feet below the surface at each sampling location. Although sample locations have generally been identified, the exact locations will be determined in the field based upon an assessment of field conditions, surface evidence of past dumping practices and contamination, and topographic relief.

The soil gas survey will be conducted using either a slam bar/OVA technique or a perforated tube/bag method. The slam bar technique uses a steel rod that is driven into the soil with a weight that slides along the top of the rod. The slam bar will be driven into the soil to a depth of three feet or to maximum penetration. When the slam bar is withdrawn, the air in the resultant hole will be analyzed with an OVA for volatile organic compounds.

The primary equipment to be used for the perforated tube/bag method consists of the following:

1. A miniature well point sampler, 5/8-inch in diameter, stainless steel, with 3/8-inch hollow center. The shaft is tipped with a sharp penetrating point and has a narrow, vertically slotted screen. The internal-thread 2.5-foot sections are driven into the soil using a special cylindrical hammer. Connectors allow hook-up to various types of sample analysis equipment.

2. An OVA for determining the total concentration of organic vapors using a flame ionization detector.

The following procedures will be followed at each of the sampling locations.

1. A decontaminated well point sampler will initially be driven into the soil to a depth of 4 feet at each location.

2. Sample tube fittings will be attached to the samples and one volume of air purged from the system using a syringe or piston displacement device.

3. A sample collection bag will be attached to the system and the bag will be filled using a syringe or piston displacement device. The sample bag will then be carried to a van for analysis.

4. The OVA will be set up and operated in the van to standardize analytical conditions. Bag samples will be allowed to equilibrate with internal van conditions. Once equilibrium has been reached, the bag sample will be connected to the OVA (operated in survey mode) and analyzed for total volatile organic substances. An activated carbon filter will be used to check for the presence of methane. Prior to each set of analyses, the OVA will be "zeroed" in a background area and ambient background readings will be recorded. Temperature readings will be recorded during the background measurement and during the sampling.

5. Depending on field conditions, it may be necessary to substitute a slightly different sample collection and analysis procedure. Should weather and soil conditions preclude the use of the analysis equipment described, the equipment and/or techniques will be modified accordingly. All modifications will be documented and appropriate controls instituted for maintaining sample integrity. In any case, the equivalent of

one air volume for each sample and depth will be purged prior to collecting the sample for analysis. If no contaminants are detected in a sample, the sample bags may be reused.

6. Upon completion of sampling at 4 feet, the well point will be blown clear with compressed air (D or E quality) and the well point will be driven to the next sampling interval (samples will be collected at 4, 7, and 10 feet). Procedures 1 to 5 will be repeated at each interval.

7. Upon completion of sampling at each location, the well point will be withdrawn from the ground and the hole backfilled by injecting a bentonite slurry into it.

8. The well point will be decontaminated as specified in Section 9. The sample analytical equipment tubing will be purged until a stable "zero" or background reading is obtained.

9. All data well point locations and sample results will be recorded in a log book of field activities. Data will be tabulated and plotted on a site base map and used for assessment and planning of future investigative work.

10. A duplicate analysis will be collected after every 20 analyses.

The OVA will be calibrated in accordance with the manufacturer's specifications twice daily, once prior to commencing operations and once after 4 hours of field sampling.

3.7 SAMPLING EQUIPMENT

Sampling equipment will be the responsibility of the equipment manager, who will assure that the items required for sampling and the necessary quantities are on-site prior to sampling. All equipment will be checked for serviceability and calibrated, if necessary, prior to shipment. Similar checks will be made at the sampling location. Any sampling device that is reusable will be decontaminated before reuse. The equipment required for sampling will include, but will not be limited to, the items listed in Table 3-1.

Table 3-1

MAJOR SAMPLING EQUIPMENT LIST

Item
Drilling rig, rod, and other components
4-inch diameter, 5-foot split spoons or 2-inch diameter, 18-inch split spoons
Hollow stem augers
Cathead and 140-pound hammer
Van
Boat
Peterson steel dredge
HNu photoionizer, calibration kit
Organic vapor analyzer (OVA), calibration kit
Combustible gas/O_2 meter, calibration kit
Temperature, pH, conductivity meter
Dust particulate counters
High volume particulate samplers
Tenax tube collectors
Meteorological data collection station
Magnetometer
Portable photovac GCs
<u>Sample Containers</u>
8-ounce glass sample bottles with Teflon lids
1/2-gallon glass sample bottles
1-liter polyethylene sample bottles with reagents
800-mL polyethylene sample bottles for inorganic sample collection
40-mL glass VOA bottles
Shipping coolers and DOT labels
Chain-of-custody forms and seals
Filter paper and prefilters
Teflon and/or stainless steel well bailers
Water level indicator with calibrated weighted line
12-foot engineer's steel tape
Stainless steel pans
Stainless steel spoons
Stainless steel scoop/trough
Miniature well point sampler, 5/8-inch diameter stainless steel with 3/8-inch hollow centers
Tubes and collection bags
Compressed air (D or E quality) tanks
Miscellaneous disposables (rope, bags, paper towels, etc.)
<u>Documents</u>
Labels
Field notebooks
Sampling plan
Site maps

Note: Sampling surfaces that come in contact with samples for analysis will be either stainless steel, teflon, high density polyethylene (HDPE), or glass.

4. SAMPLE PREPARATION

4.1 COORDINATION WITH ANALYTICAL LABORATORY

It is important that any limitation on sampling due to laboratory capacity or special sample requirements be determined prior to sampling. Based on the analyses required, no special sampling requirements are anticipated. However, the site team leader will be responsible for contacting E & E's Analytical Services Center (ASC) well in advance of sampling to determine that laboratory capacity is adequate. At present, all analytical work is to be performed by the ASC with the exception of dioxin analyses. The dioxin analyses will be performed by a USEPA contract laboratory approved for dioxin analysis.

4.2 SAMPLE CONTAINERS

The sample containers, volumes, preservatives, and holding times will be as indicated in Table 4-1. Prewashed sample containers will be provided by the ASC and prepared in accordance with USEPA procedures. Filled containers to be shipped or stored on-site will be wiped with paper towels. All samples will be iced prior to shipment.

4.3 ANALYTICAL METHODS

All analytical methods to be utilized for this project are USEPA-approved. Methodologies specify QC requirements, including calibration, tuning, and laboratory QC samples.

In addition, all analytical staff members will follow protocols set forth in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and QA/QC Procedures Manual (August 1985).

Table 4-1

SAMPLE CONTAINERS, VOLUMES, PRESERVATION, AND HOLDING TIMES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per Sample)	Preservation	Maximum Holding Time
Purgeable (Volatile) Organics	40-ml glass vial with Teflon-backed septum	Two (2); fill completely, no air space	Cool to 4°C (ice in cooler)	7 days
Extractable Organics, PCBs, Pesticides	1/2-gallon bottles with Teflon-lined caps	Two (2); total volume approx. 1 gallon; fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days
Metals	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill 7/8 full	Nitric acid to below pH 2 (approx. 1.5 ml Con HNO_3 per liter)	6 months
Cyanides	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill completely	Sodium hydroxide to pH 12 and cool to 4°C (ice in cooler)	24 hours, if sulfide present; 14 days
2,3,7,8 TCDD	8-oz. glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days

Note: Soil samples for metals analysis will be delivered in one 8-oz. jar with Teflon-lined cap half-filled. The laboratory staff can then homogenize the sample by mixing it in the original sample container. Soil samples for extractables and cyanides will be delivered in one 8-oz. jar with Teflon-lined caps filled completely.

5. FIELD PERSONNEL REQUIREMENTS

The sampling team for the project will consist of three to five members, all of whom are experienced in the types of sampling activities planned at the Dead Creek sites. The team members' duties are listed below. Record custodian and site safety duties will be rotated, so team members other than the team leader may have either function during the sampling.

Team Leader--will have the overall responsibility for the sampling team's activities. Responsibilities include overall team coordination; relaying information to the record custodian; directing team members to the sample locations; directing sample gathering methods and sample quantities; and any other operations relevant to the sampling effort.

Record Custodian--will record all information in the appropriate field logs. He will also prepare sample labels and bottles, and provide other necessary support for sampling.

Site Safety Monitor--will be responsible for the team's overall safety. He will make the necessary measurements of explosivity, O_2, etc., and will also insure that proper safety protocols are followed. In addition, the site safety monitor will assist in collecting samples.

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Additional team members (samplers) will be present to lend support where necessary, as in sample gathering, sample preparation for shipping, and in general assist in all phases of sampling when required by the team leader.

6. SITE LOGISTICS

At each site, the layout will consist of an exclusion zone which is entered through a support zone and a contamination reduction zone. The line between the exclusion zone and the contamination reduction zone is called the hot line. All areas where contamination has been found are in the exclusion zone; a support zone will be designated upon arrival at the site.

No one will enter the exclusion zone without the required level of protective equipment and air monitoring equipment. Levels of protection will vary from site-to-site and in accordance with the type of sampling activities being performed. On the basis of air monitoring data, the level of protection for each site may also be upgraded and downgraded as directed by the site safety monitor. (See the Site Safety Plan for levels of protection.) Team members will enter the exclusion zone in pairs, employing the "buddy system," and a pair will exit the exclusion zone at the same time. Upon exiting the exclusion zone, personnel and equipment will be decontaminated. Work will be limited to daylight hours.

Some specific considerations for each task are noted below:

Surface Soil Sampling

- Monitoring of the surface soil sampling locations for combustibility and oxygen content will be performed prior to and during sampling. Organic vapor readings may be used as the basis for upgrading and downgrading the level of personnel protection.

- Sampling spoons and any other equipment that will be reused will be decontaminated before and after use.

Subsurface Soil Samples

- Monitoring of the split-spoon sampling locations for combustibility and oxygen content will be performed prior to and during sampling. In addition, prior to sampling, magnetometer readings will be taken to determine if there is any metal below the surface.

- Split-spoon samplers, augers, and other equipment that will be reused will be decontaminated before reuse.

- The decontamination of the split-spoons will be completed at the sampling location.

Monitoring Well Sampling

- Monitoring of wells for combustibility, oxygen content, and organic vapor content will be performed upon opening each well. Where elevated combustible gas readings or organic vapor readings are found, the well will be allowed to vent prior to determining the static water level and purging. Air monitoring will continue during purging and sampling of the well.

- All purge water will be placed in a drum for later disposal.

- Any sampling devices used will be decontaminated.

Creek Water/Sediment Sampling

- Personnel collecting the sample will be secured to the bank of the creek with a safety line.

Soil Gas Survey

- Monitoring of the soil gas survey locations for combustibility and oxygen content will be performed prior to and during the survey. Organic vapor readings observed during the survey may be used as the basis for upgrading or downgrading the level of personnel protection.

- All equipment that will be reused will be decontaminated before and after reuse.

7. SAMPLE HANDLING, PACKAGING, AND SHIPPING

The transportation and handling of samples will be accomplished in such a way as to protect the integrity of the sample and also preclude detrimental effects due to the possible hazardous nature of the samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

All chain-of-custody requirements will comply with all USEPA sample handling protocol. Sample control and chain-of-custody procedures are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual (August 1985).

7.1 SAMPLE PACKAGING

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed.

- All sample lids will remain with the original containers. Custody seals will be affixed.

- The sample volume level will be marked by placing the top of the label at the sample level, or by using a grease pencil. This procedure will help the laboratory determine if any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC marks.

- Sample bottles will be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination.

- Shipping coolers must be filled initially with approximately 3 inches of vermiculite or zonolite.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- Environmental samples will to be cooled. The use of "blue ice" or some other artificial icing material is preferred. If necessary, ice may be used, provided that it is placed in plastic bags. Ice is not to be used as a substitute for packing materials.

- Any remaining space in the cooler will be filled with inert packing material. Under no circumstances will material such as sawdust, sand, etc., be used.

- A duplicate custody record will be placed in a plastic bag and taped to the bottom of the cooler lid.

Note: The ASC does not knowingly accept samples with high levels of radioactivity or dioxins, or any samples for which ASC handling procedures may be insufficient to protect laboratory employees. Field staff will take all feasible precautions, to ensure that neither they nor ASC personnel are exposed to unduly hazardous materials. Note that field staff are in many cases equipped with personal protection and breathing apparatus not used by ASC personnel.

7.2 SHIPPING CONTAINERS

Environmental samples will be properly packaged and labeled for shipment and dispatched to the ASC laboratory for analysis. A separate chain-of-custody record will be prepared for each container. The following requirements for shipping containers will be followed.

Shipping containers will be padlocked or custody-sealed for shipment, as appropriate. The container custody seal will consist of filament tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the filament tape and breaking a seal.

All shipping containers must be secured by field personnel with a proper custody seal, marked with indelible pen or ink, and addressed to Ecology and Environment, Inc., Analytical Services Center, 4285 Genesee Street, Buffalo, NY 14225.

Field personnel will arrange for transportation of samples to the ASC. When custody is relinquished to a shipper, field personnel will telephone the ASC custodian (716/631-0360) to inform him of the expected time of arrival of the shipment and advise him of any time constraints on sample analysis. The ASC must be notified as early in the week as possible, and in no case later than Thursday at 3 p.m. (eastern standard time), regarding samples intended for Saturday delivery. Samples will be retained by the ASC for 30 days after the final report is submitted.

7.3 MARKING AND LABELING

The following procedures will be used for marking and labeling sample packages.

- Use abbreviations only where specified.

- The words "This End Up" or "This Side Up" will be clearly printed on the top of the outer package. Upward-pointing arrows will also be placed on the sides of the package. The words "Laboratory Samples" will also be printed on the top of the package.

- After a package has been sealed, two chain-of-custody seals will be placed on the container, one on the front and one on the back. The seals will be protected from accidental damage by placing Mylar tape over them.

8. DOCUMENTATION

8.1 SAMPLE IDENTIFICATION

All containers of samples collected for the Dead Creek Project will be identified using the following format on a label or tag fixed to the sample container (labels are to be covered with Mylar tape):

DC-XX-O/D

- DC - This set of initials indicates the sample is from the Dead Creek Project.
- XX - These characters identify the sample location. If the identification is only one character, the first of these characters will be "0." Actual sample locations will be recorded in the task log.
- O/D - This character will be either "O" for original sample, or "D" for duplicate.

Each sample will be labeled and sealed immediately after collection. To minimize handling of sample containers, labels will be filled out prior to sample collection. The sample label will be filled out using waterproof ink and firmly affixed to the sample container and protected with Mylar tape. Labels must include:

- Name of collector (team leader),
- Date and time of collection,
- Sample number,
- Sample volume,
- Analysis required,
- pH, and
- Preservatives used.

8.2 DAILY LOGS

Daily logs and data forms are necessary to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project and to refresh the memory of the field personnel if they are required to give testimony during legal proceedings.

Daily logs will be kept in a bound waterproof notebook containing numbered pages. Entries will be made in waterproof ink, dated, and signed. No pages will be removed for any reason. Corrections will be made according to the procedures given at the end of this section. The daily logs will include a site log and a task log.

The Site Log will include a complete summary of each day's activities at the site. The site log is the responsibility of the team leader.

The Task Log will include:

- Name of person making entry (signature).
- Time of day entry is made.
- Levels of personnel protection:
  - Level of protection originally specified,
  - Changes in levels of protection,
  - Reasons for changes, and
  - Time of changes.
- Names of team members on-site.
- Time spent on-site.
- Tasks performed.
- Changes in instructions or activities that occurred on-site.
- Weather conditions, wind direction, etc.

- Documentation on photographs taken.
- Documentation on samples taken, including:
  - Sampling location,
  - Station numbers,
  - Sampling date and time,
  - Name of sampling personnel,
  - Type of sample (composite, grab, etc.), and
  - Sample medium type (e.g., groundwater).
- On-site measurement data.
- Field observations and remarks.
- Unusual circumstances or difficulties.
- Initials of person recording the information.

8.3 LOGBOOK CORRECTIONS

No pages will be removed from logbooks for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

8.4 PHOTOGRAPHS

Photographs will be taken only as directed by the team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the task log concerning photographs:

- Date, time, location of photograph,
- Photographer (signature),
- Description of subject of photograph,
- Weather conditions,
- Reasons why photograph was taken,
- Sequential number of the photograph and the film roll number, and
- Camera lens system used.

After the photographs have been developed, applicable information in the field notebook should be transferred to the back of each photograph.

8.5 CHAIN-OF-CUSTODY

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the possession and handling of a sample from the time of collection through analyses. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area restricted to authorized personnel.

8.5.1 Field Custody Procedures

- As few persons as possible should handle samples.

- The sample collector is personally responsible for the care and custody of samples until they are transferred to another person or properly dispatched.

- The sample collector will record sample data in the field notebook.

- The team leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

8.5.2 Sample Tags

Sample tags will be attached to or affixed around each sample container in the field. The sample tags will be placed on bottles so as not to obscure any QA/QC data on the bottles. Information on tags will be printed in a legible manner using waterproof ink. Information on sample tags will be sufficient to enable cross-reference with the site logbook. QC samples are subject to the same custodial procedures and documentation as primary samples.

8.5.3 Chain-of-Custody Record

The chain-of-custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated by the project manager as responsible for sample shipment. In addition, if samples will require rapid turnaround in the laboratory because of project time constraints or analytical concerns, the person completing the chain-of-custody record should note these constraints in the remarks section of the custody record.

8.5.4 Transfer of Custody and Shipment

- Samples will be accompanied by a chain-of-custody record. When transferring samples, individuals relinquishing and receiving them must sign, date, and note the time on the record. This record documents sample custody transfer.

- Samples will be dispatched to the ASC for analysis with a separate chain-of-custody record accompanying each shipment. Shipping containers must be sealed with custody seals. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the chain-of-custody record.

- All shipments must be accompanied by the chain-of-custody record identifying their contents. The original record will accompany the shipment, and the yellow copy will be retained by the team leader.

8.5.5 Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. A custody seal is placed over the cap of individual sample containers by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. Upon receipt at the laboratory, the custodian will check (and certify, by completing logbook entries) that seals on boxes and bottles are intact. Clear tape will be placed over the seals to ensure that seals are not accidentally broken during shipment.

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9. DECONTAMINATION

Sampling methods and equipment have been chosen to minimize decontamination requirements and the possibility of cross contamination. Any sample tubing, rope, rods, etc., will be disposed of after sampling. Sampling equipment used on more than one location will be decontaminated between locations by following these steps:

- Steam clean (drilling equipment only);
- Scrub with brushes in trisodium phosphate (TSP) solution;
- Rinse with deionized water;
- Rinse with acetone;
- Rinse with hexane;
- Rinse with acetone; and
- Rinse with deionized water.

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10. SITE MAPS

This section contains location specific maps for the Dead Creek Project sites. The maps include the location of all existing wells at the sites as well as all proposed monitoring well locations and delineation of specific sampling points where possible.

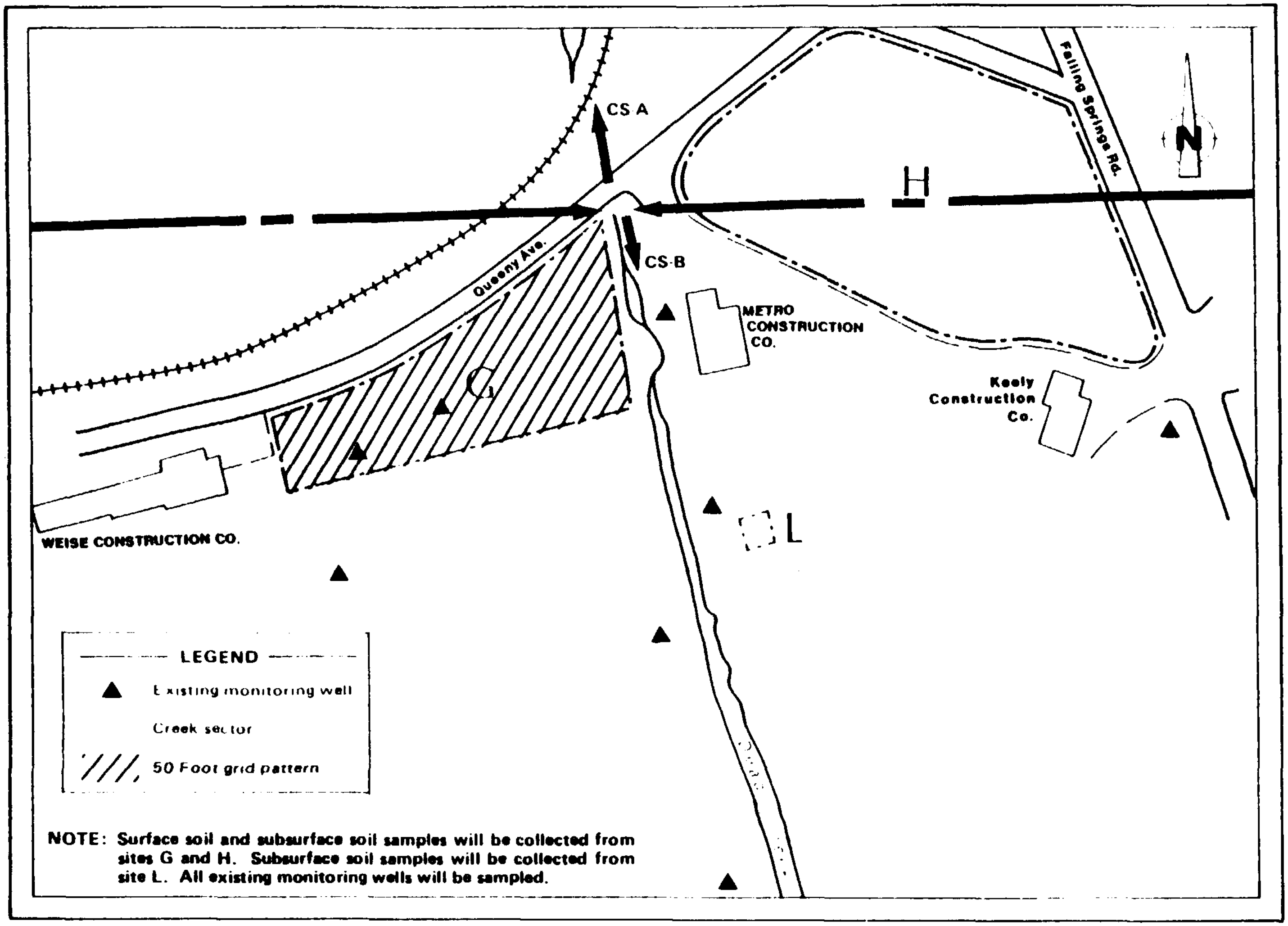

Figure 10–1 DEAD CREEK SITE AREAS G, H AND L, AND CREEK SECTORS A AND B SAMPLING

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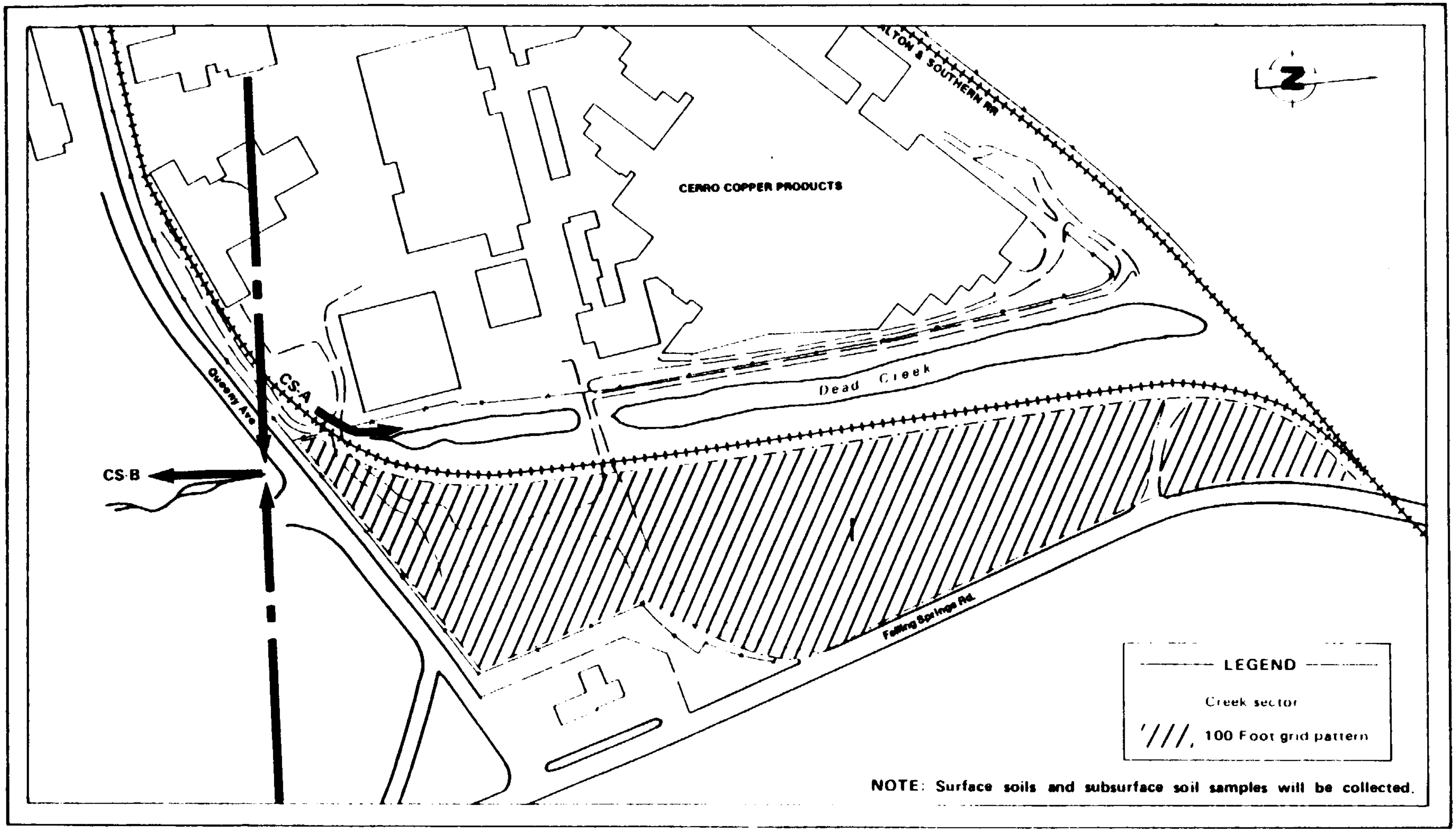

Figure 10–2 DEAD CREEK SITE AREA I, AND CREEK SECTORS A AND B SAMPLING

Draft

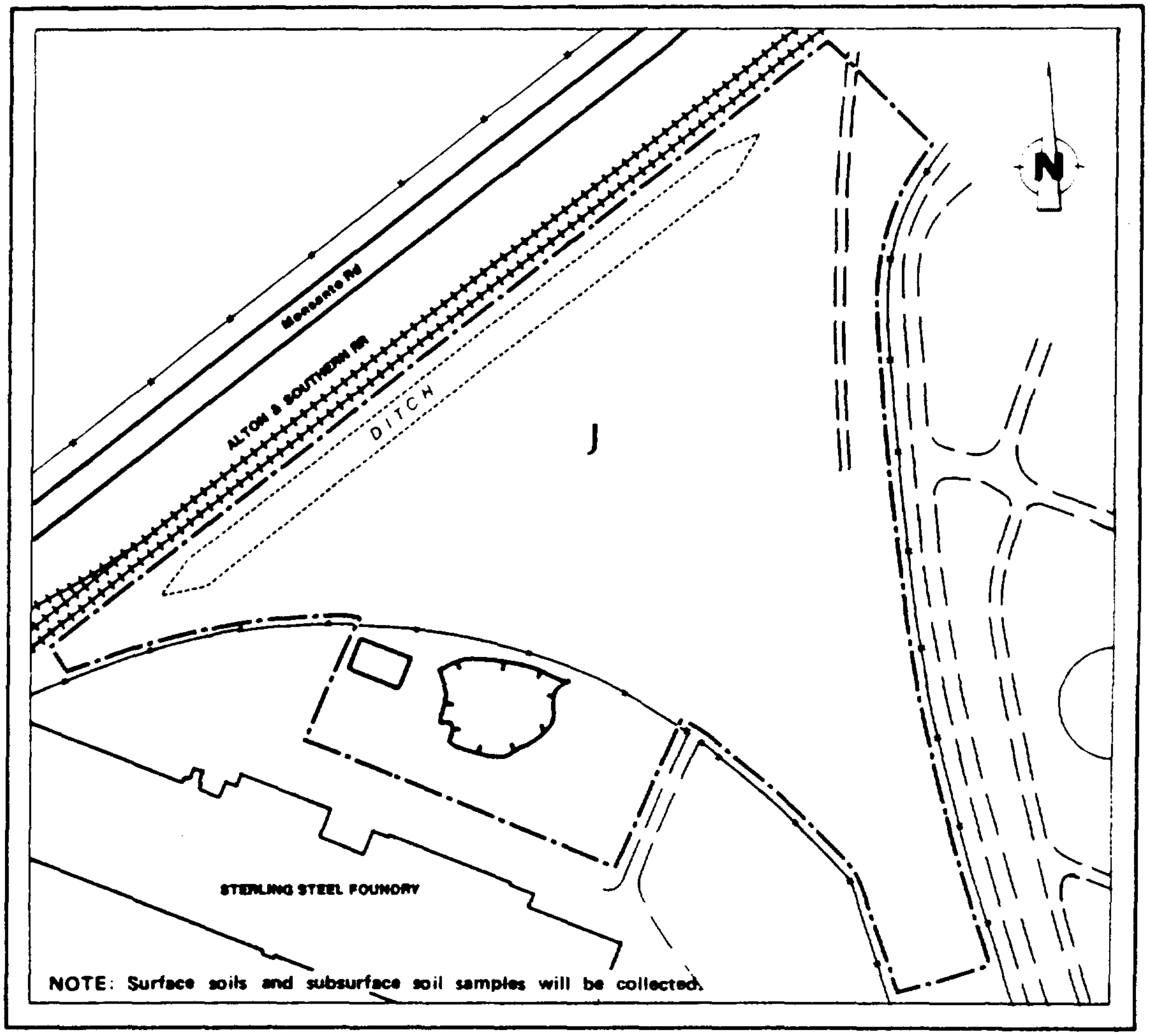

Figure 10–3 DEAD CREEK SITE AREA J SAMPLING

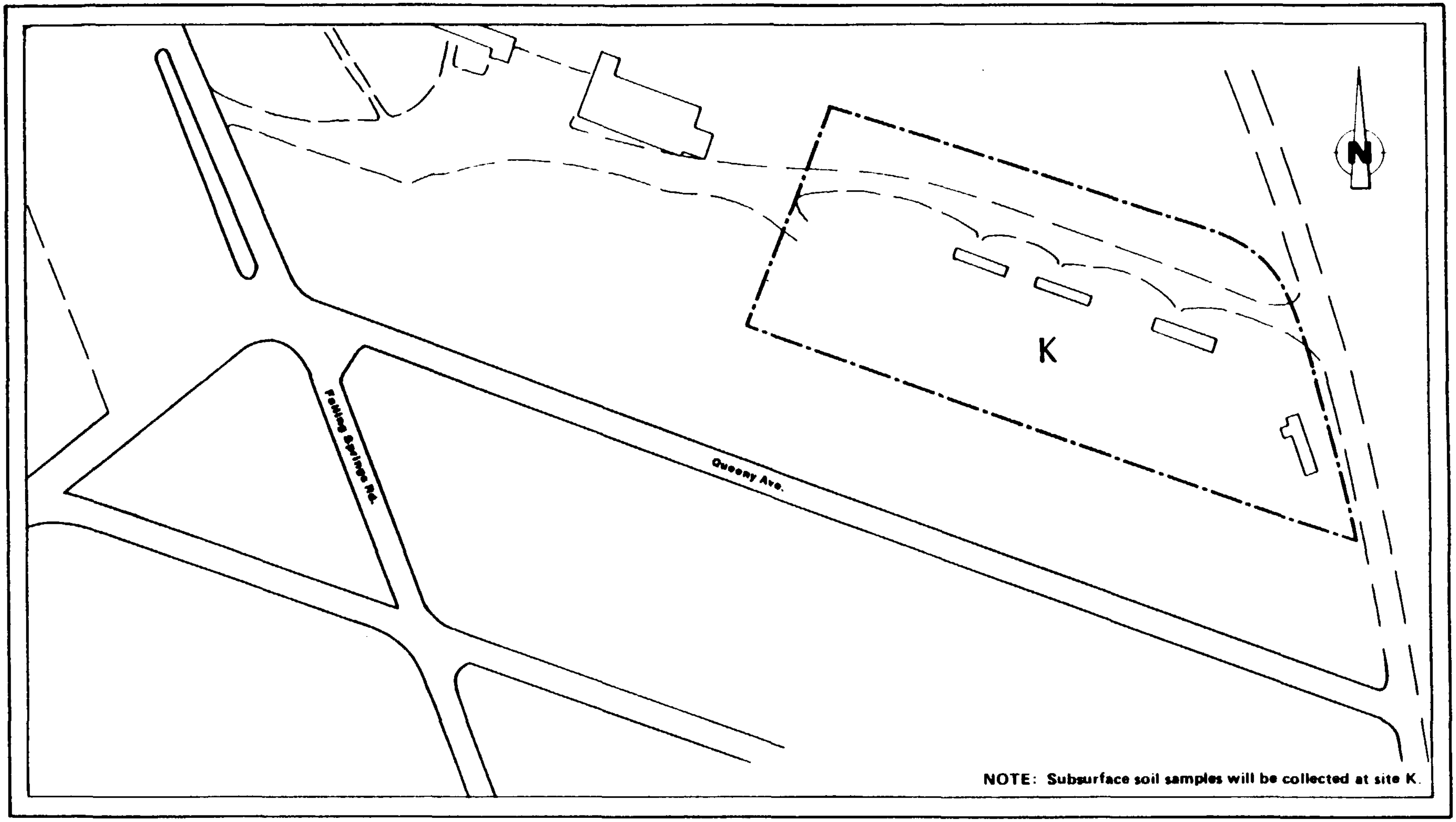

Figure 10–4 DEAD CREEK SITE AREA K SAMPLING

Draft

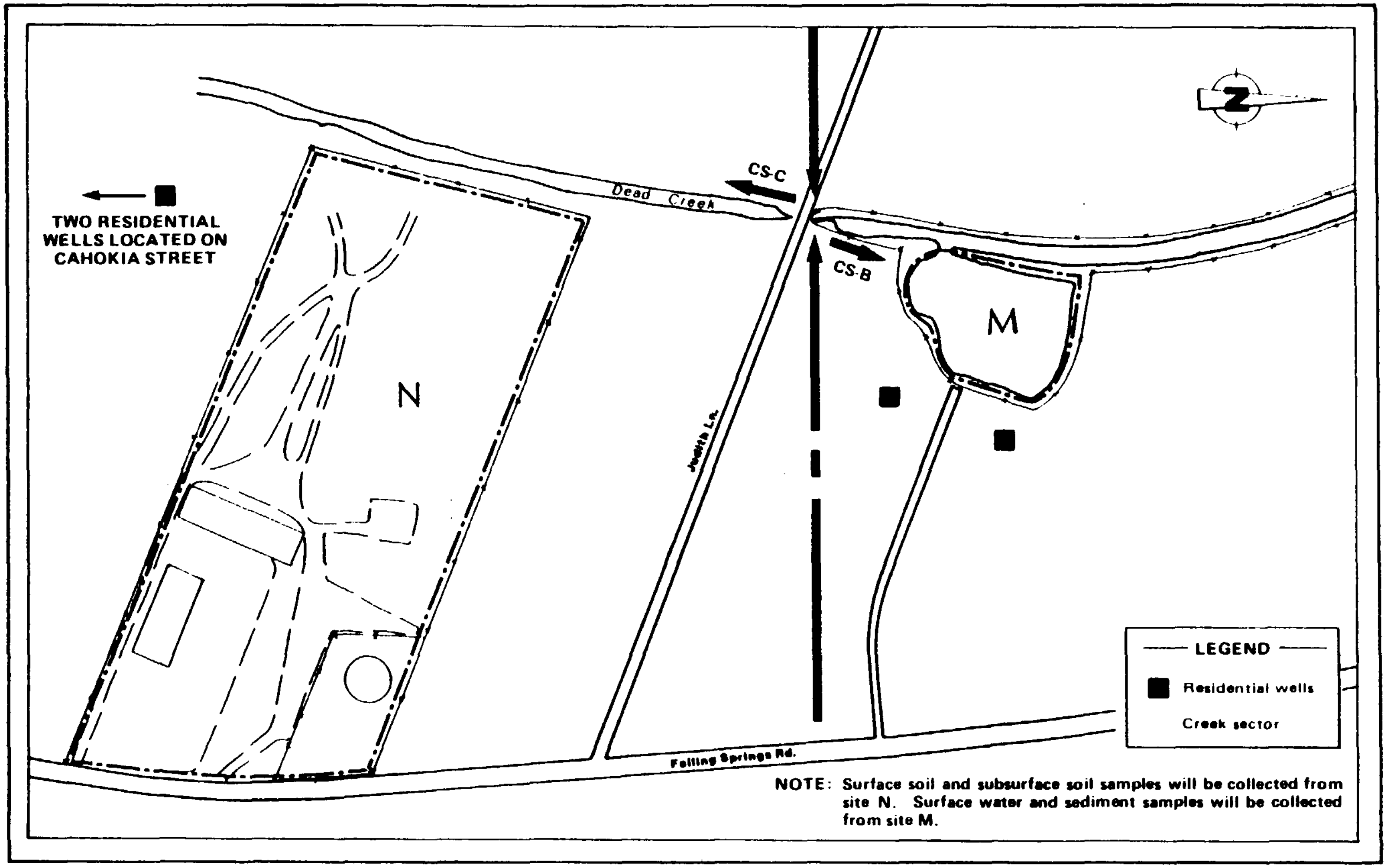

Figure 10–5 DEAD CREEK SITE AREAS N AND M, AND CREEK SECTORS B AND C SAMPLING

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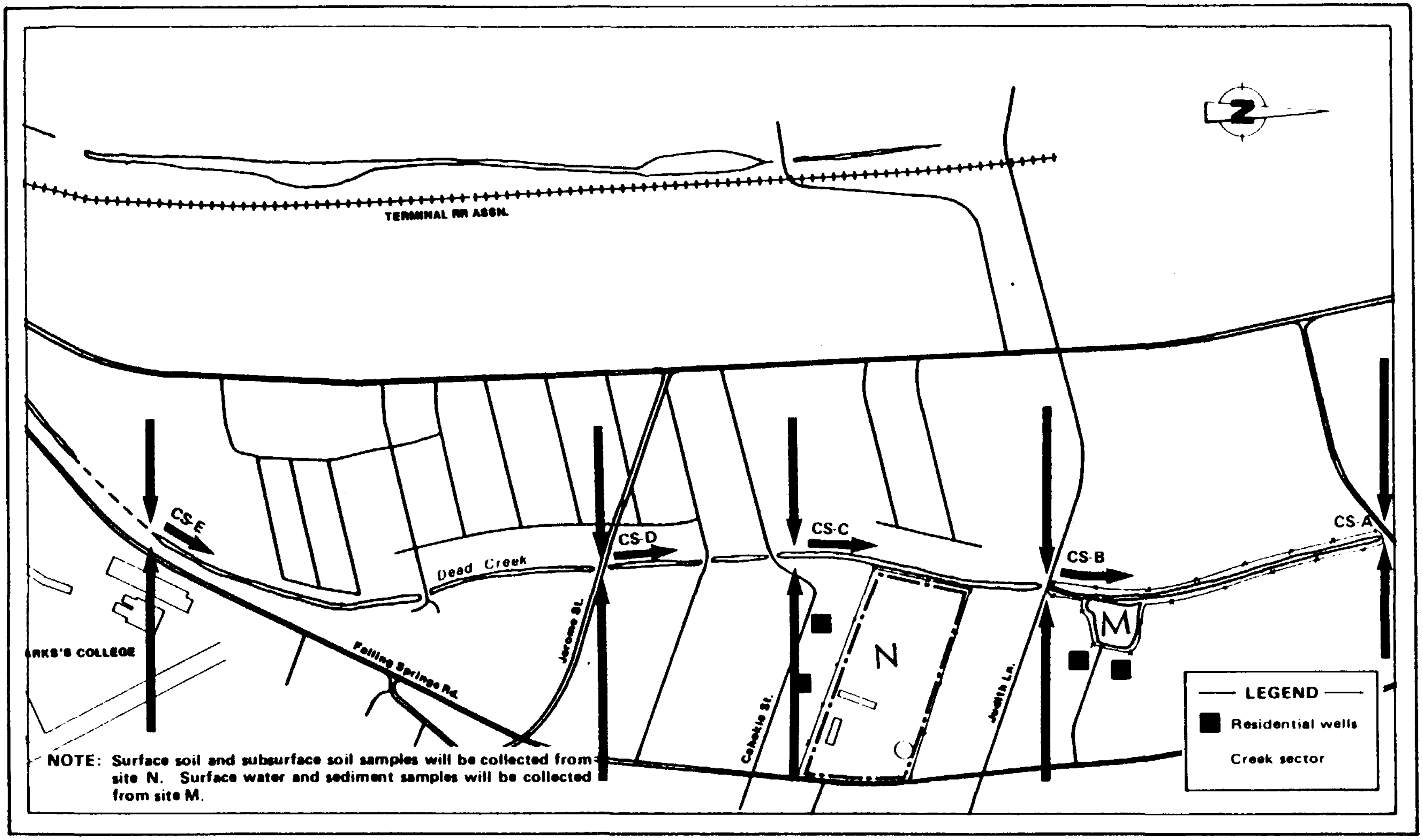

Figure 10–6 DEAD CREEK SITE AREAS N AND M, AND CREEK SECTORS A, B, C, D, E, AND F SAMPLING

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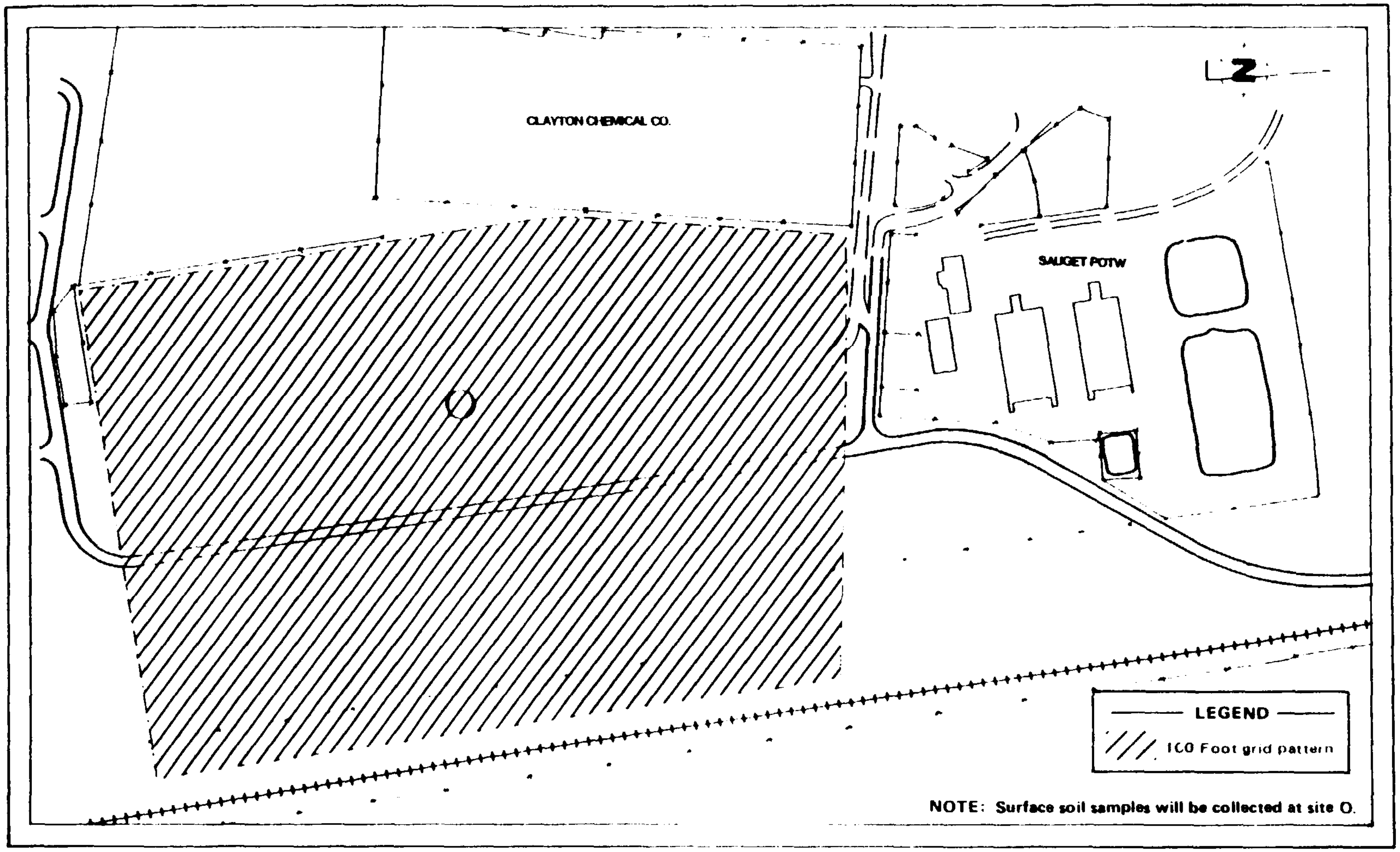

Figure 10–7 DEAD CREEK SITE AREA O SAMPLING

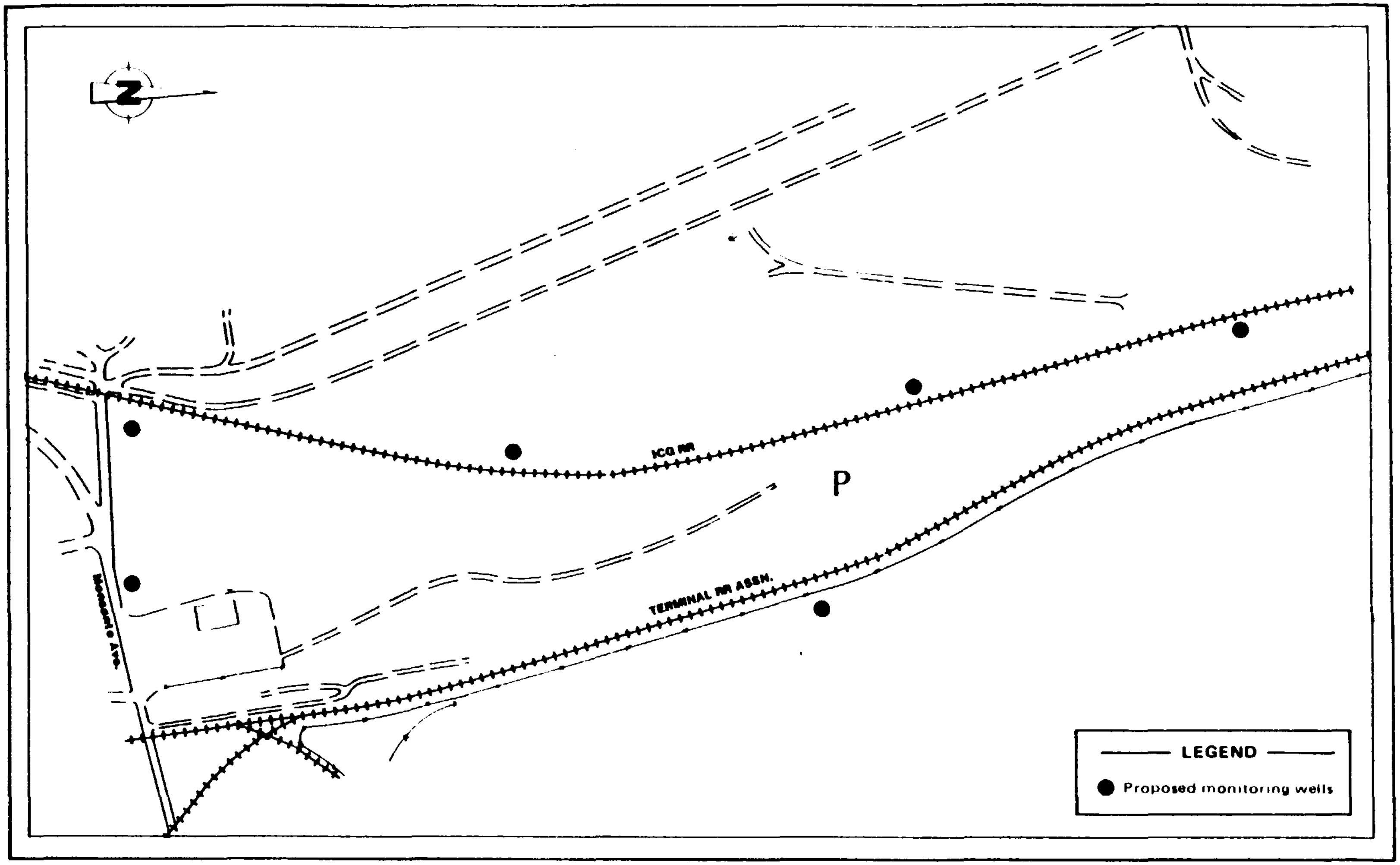

Figure 10–8 DEAD CREEK SITE AREA P PROPOSED MONITORING WELL LOCATIONS

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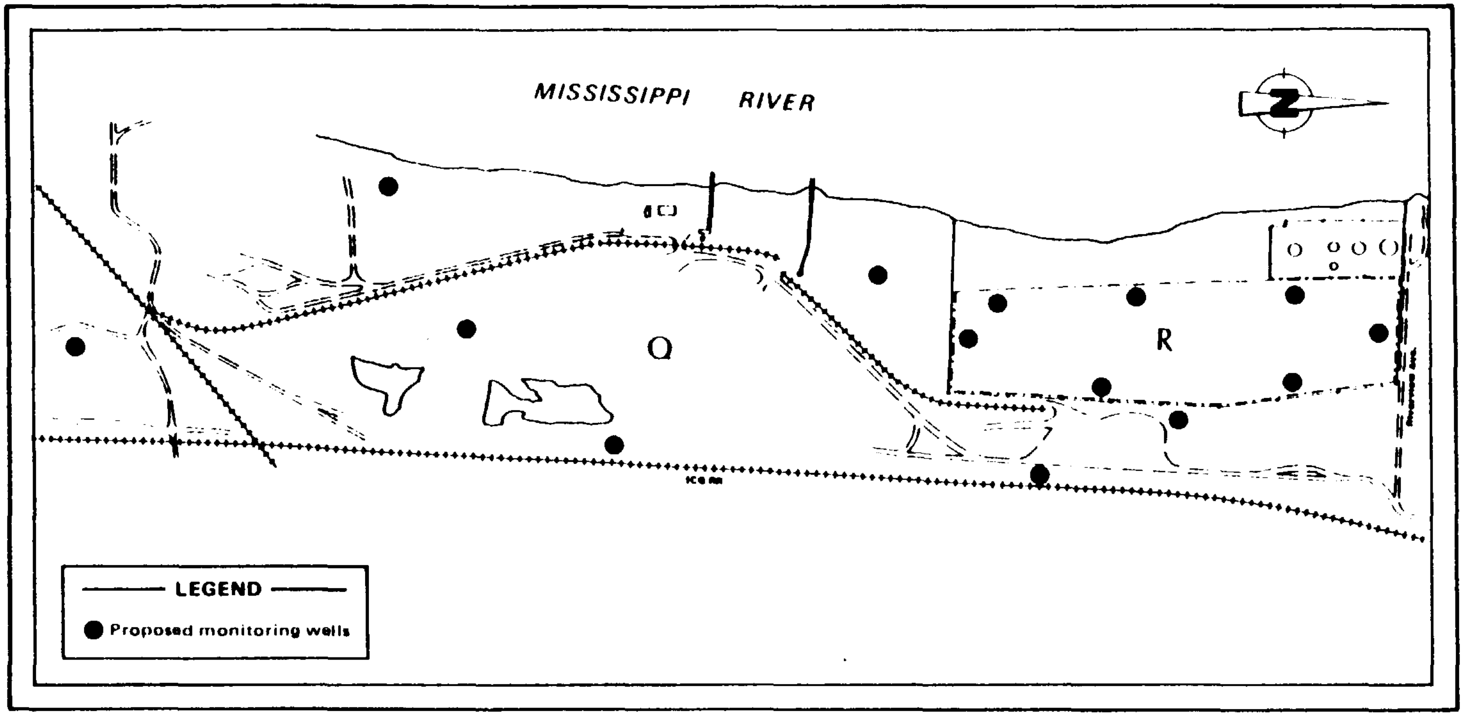

Figure 10–9 DEAD CREEK SITE AREAS Q AND R PROPOSED MONITORING WELL LOCATIONS

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APPENDIX C

DRAFT HEALTH AND SAFETY PLAN,
DEAD CREEK PROJECT

February 1986

Prepared for:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Draft

ecology and environment, inc.

HAZARDOUS AND TOXIC MATERIALS TEAM
SITE SAFETY PLAN

A. GENERAL INFORMATION

SITE: Dead Creek Project   Job No.: IL-3020

LOCATION: Sauget and Cahokia, Illinois

PLAN PREPARED BY: Dan Sewall   DATE: 2/6/86

APPROVED BY: (Initial Review of Draft)   DATE: 2/7/86

OBJECTIVE(S): **Monitoring Well Installation, Surface and Subsurface Soil Sampling, Surface and Groundwater Sampling, Soil-Gas Survey.**

PROPOSED DATE OF INVESTIGATION: March - May 1986:

BACKGROUND REVIEW: Complete: ____ Preliminary: X

DOCUMENTATION/SUMMARY: Overall Hazard: Serious: X Moderate: ____ Low: ____ Unknown: ____

B. SITE/WASTE CHARACTERISTICS

WASTE TYPE(S): Liquid X Solid X Sludge X Gas ____

Corrosive X Ignitable X Radioactive ____ Volatile X

Toxic X Reactive X Unknown X Other (Name) teratogenic; carcinogenic, mutagenic

FACILITY DESCRIPTION: The study area consists of 18 sites (370 acres) including: manufacturing facilities, inactive landfills, surface impoundments, and Dead Creek.

Principal Disposal Method (type and location): Landfill (area filling), waste piles, surface impoundments, open dumping.

Unusual Features (dike integrity, power lines, terrain, etc.): **Power lines** traverse the entire area west of Rte 50. **A flood control levee** is located immediately east of Site Q - see map.

Status: (active, inactive, unknown) Inactive, other than manufacturing facilities.

History: (injuries; complaints; previous agency action): Illinois EPA has received several complaints dating back to the early 1970's concerning dumping in Dead Creek. A fence was constructed around the creek and Site M from Judith Ln. to Queeny Ave. as a result of a preliminary study done by IEPA in this area. The Illinois Pollution Control Board and the Attorney General's Office have been involved in actions concerning Sites Q and R.

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C. HAZARD EVALUATION
(Use Supplemental Sheets if Necessary)

Summary (attach copy of available chemical information from Saxs, Merck Index, Ohmtads, etc.): The following is a brief list of contaminants found at various sites in the study area during past agency and contractor investigations. This list is by no means a complete compilation of all contaminants found or suspected, and is provided simply as an indication of the types of contaminants which may be encountered during field activities.

2,3,7,8-TCDD (Dioxin)
PCB's (Not specified)
o-Dichlorobenzene
Dichlorophenol
Lead
Cadmium
Arsenic
Chlorotoluene
Phosphorus (not specified)
Pentachlorophenol
Vinyl chloride
Phosgene
Mercury
See attached hazard evaluation sheets for specific information.

D. SITE SAFETY WORK PLAN

PERIMETER ESTABLISHMENT: Map/Sketch Attached? Yes Site Secured? A

Perimeter Identified? Yes Zone(s) of Contamination Identified? B

A. Secured sites include: Dead Creek (Queeny to Judith); Sites I, M, N, R.

B. Zones preliminarily identified - investigation incomplete. Assume entire area to to be contaminated.

PERSONAL PROTECTION:

Level of Protection: A ____ B X C X D X

Modifications: MINIMUM protective clothing will include: neoprene boots (steel toe and shank), hooded Tyvek or Saranac coveralls, neoprene gloves, disposable latex booties, disposable latex gloves, hard hats. See attachment for task-specific levels of protection.

Surveillance Equipment and Materials: All field activities will include monitoring with an Hnu (10.2 lamp) or OVA, rad-mini, and cyanide meter or monitox, and an explosimeter/O_2 meter, GCA/MDA real time particulate meter.

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PERSONAL PROTECTION (Cont.):

Action Levels:

OVA/Hnu - 0 ppm above background - Level D

1 - 5 ppm above background - Level C

6 - 500 ppm above background - Level B - Contact Regional Safety Coordinator (RSC) prior to upgrade.

>501 ppm above background - Level A

O_2 Meter - <19.5% - Level B

>25% - Leave area, contact RSC.

<10% Explosimeter - <20% LEL - Continue operation.

20-50% LEL - Identify source, initiate vapor suppressional measures

>50% LEL - Leave area

Particulate Monitor - >2 mg/m^3 - Initiate dust suppression measures

Monitox CN Monitor - >5 mg/m^3 - Level A OK

Rad-mini - Any readings - depart site and contact RSC.

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SPECIAL SITE CONSIDERATIONS: See attachment.

DECONTAMINATION PROCEDURES:

Personal: Disposable protective clothing will be bagged, labeled, and drummed. Boot and glove wash with TSP and water. Formal hot line set up necessary.

?

Equipment: TSP & water wash with rinse as necessary. Sampling equipment: TSP-water wash followed by solvent rinse (acetone-hexane-acetone) DI water rinse. All drilling equipment (augers, split spoons...) to be steam-cleaned.

INVESTIGATION - DERIVED MATERIAL DISPOSAL: (Note - If material is proposed to be left on site, written authorization is to be received by the Project Team Leader prior to the initiation of on site activities): Drill cuttings, purge water will be containerized and moved inside Dead Creek fence. Other disposables will be bagged, labeled, and containerized prior to moving inside Dead Creek fence.

SITE ENTRY PROCEDURES: Decontamination station will be determined each day based on weather conditions. Entry procedures will include ambient air monitoring with surveillance equipment.

Team Member	Responsibility
Mike McCarrin	Team Leader
Dan Sewall	Safety Officer
*	TBA
*	TBA
Drillers/subcontractor personnel	

*Additional members to be determined. Project log book will include team members and dates present for all field activities. All subcontractor personnel are to provide SSC with written certification of medical approval, training status, and ability to wear specified respiratory equipment.

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SPECIAL SITE CONSIDERATIONS

All drilling locations will be cleared using a magnetometer prior to initiating drilling. Local utilities will be contacted to define subsurface transmission lines. Maneuverability is limited in Dead Creek area north of Judith Lane. Care should be taken to minimize stressful conditions resulting from extreme temperatures. Heat stress symptoms will be monitored and recorded in the SSC's log book. Work will be conducted during daylight hours only. Air compressor to be located upwind of site at all times during filling operations. Air quality for hydrocarbons, CO, moisture to be checked prior to use.

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E. EMERGENCY INFORMATION

(Use Supplemental Sheets if Necessary)

EMERGENCY PRECAUTIONS

Acute Exposure Symptoms	First Aid
Chlorotoluene: Severe irritation of skin and respiratory system	Wash irritated areas with water; get medical aid
Pentachlorophenol: Dust and vapors irritate skin and mucous membranes - severe coughing and sneezing	Ingestion: Immediately induce vomiting Dermal: Wash affected areas with soap and water
PCB's: Rash and acne from dermal contact	Ingestion: Provide water, induce vomitting
2,3,7,8-TCDD: Acne, skin and eye irritation, respiratory distress	Dermal: Soap and water wash

*See attached hazard evaluation sheets for additional information.

LOCAL RESOURCES
(Name, Address and Phone Number)
LOCAL AREA CODE: 618

Ambulance 332-6600 Sauget Fire Dept.

Hospital Emergency Room 874-7076 Christian Welfare Hospital

Poison Control Center 1-800-252-2022 St. John's Hospital - Springfield

Police (incl. Local, County Sheriff, State) 332-6500 (Sauget), 1-277-3500 (County), 345-1212 (State)

Fire Department 332-6600

Airport 337-6060 Bi-State Parks Airport, Cahokia

Explosives Unit 345-1212 - State Police

Agency Contact (EPA, State, Local, USCG, etc.) 217/782-6760 - Jeff Larsen - IEPA

Local Laboratory 235-1780 - St. Clair Medical Laboratory

Federal Express 314/367-8278; 6181 Aviation Dr., St. Louis Airport

Client Contact Jeff Larsen, IEPA - Springfield 217/782-6760

SITE RESOURCES

Water Supply 5 gallon collapsible containers will be used.

Telephone Falling Springs Rd. and Queeny Ave.; Rte. 3 and Monsanto Ave.

Radio To be determined.

Other --

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Add ESDA phone + SRI phone

Emergency Contacts

1. Mr. Raymond Harbison (University of Arkansas) .... (501) 661-5766 or 661-5767
   (501) 370-8263 (24 hour)

2. Paul D. Moss, Regional Safety Coordinator/Chicago .... (312) 663-9415 (office)
   (312) 541-6635 (home)

3. Ecology and Environment, Inc., Corporate Safety Director/
   D. Dahlstrom .... (716) 632-4491 (office)
   (716) 741-2384 (home)

Medtox Hotline

1. Twenty-four hour answering service - (501) 370-8263

   What to Report:

   - State: "This is an emergency."
   - Your name, region, and site.
   - Telephone number to reach you.
   - Your location.
   - Name of person injured or exposed.
   - Nature of emergency.
   - Action taken.

2. One of three toxicologists (Drs. Raymond Harbison, Glenn Milner, or Robert James) will contact you. Repeat the information given to the answering service.

3. If a toxicologist does not return your call within 15 minutes, call the following persons in order until contact is made:

   E & E Corporate Headquarters (EST 0830-1700) - (716) 632-4491

   a. Twenty-four hour line - (716) 631-9530
   b. Corporate Safety Director - David Dahlstrom (home - (716) 741-2384)
   c. Assistant Corporate Safety Officer - Steve Sherman (home - (716) 688-0084)

Emergency Routes

Directions to Hospital (incl. MAP) Monsanto Ave. east to Monsanto Rd. (19th St. in E. St. Louis) north on 19th St. to Converse Ave. West on Converse Ave. to 15th St. North on 15th St. to King Drive. East on King Dr. to Christian Welfare Hospital. Routes to be driven by designated site personnel prior to initiating on-site operations.

Other To BI State Parks Airport: State Route 50 south to Judith Lane. East on Judith Lane to Cahokia Rd. South on Cahokia Rd. to Julian Ave. East on Julian Ave. to Airport Rd.

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F. EQUIPMENT CHECKLIST

PROTECTIVE GEAR

LEVEL A

SCBA	
SPARE AIR TANKS	
ENCAPSULATED SUIT	
SURGICAL GLOVES	
NEOPRENE SAFETY BOOTS	
BOOTIES	
GLOVES (TYPE ________)	
OUTER WORK GLOVES	
HARD HAT	
CASCADE SYSTEM	

LEVEL B

SCBA	X
SPARE AIR TANKS	X
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE SARANAC (HOODED))	X
RAIN SUIT	X
BUTYL APRON	
SURGICAL GLOVES	X
GLOVES (TYPE VITON)	X
OUTER WORK GLOVES	
NEOPRENE SAFETY BOOTS	X
BOOTIES	X
HARD HAT WITH FACE SHIELD	X
CASCADE SYSTEM	
MANIFOLD SYSTEM	X
AIR COMPRESSOR	X

LEVEL C

ULTRA-TWIN RESPIRATOR	X
RACAL POWER AIR PURIFYING RESPIRATOR	X
RACAL CARTRIDGES (TYPE GMC-H AEP-3)	X
ROBERTSHAW ESCAPE MASK	
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE SARANAC (HOODED))	X
RAIN SUIT	X
BUTYL APRON	
SURGICAL GLOVES (LATEX)	X
GLOVES (TYPE VITON - NEOPRENE)	X
OUTER WORK GLOVES	
NEOPRENE SAFETY BOOTS	X
HARD HAT WITH FACE SHIELD	X
LATEX DISPOSABLE BOOTIES	X

LEVEL D

ULTRA-TWIN RESPIRATOR (AVAILABLE)	X
CARTRIDGES (TYPE GMC-H)	X
ROBERTSHAW ESCAPE MASK (AVAILABLE)	
CHEMICAL RESISTANT COVERALLS	X
PROTECTIVE COVERALL (TYPE TYVEK, SARANAC)	X
RAIN SUIT	
NEOPRENE SAFETY BOOTS	X
BOOTIES (LATEX)	X
WORK GLOVES	
HARD HAT WITH FACE SHIELD	X
SAFETY GLASSES	X

INSTRUMENTATION

OVA	X
THERMAL DESORBER	
O2/EXPLOSIMETER	X
EXPLOSIMETER CALIBRATION KIT	X
HNU W/10-2 EV LAMP	X
VICTOREEN 471	
MAGNETOMETER	X
PIPE LOCATOR	
WEATHER STATION	X
DRAEGER PUMP	
BRUNTON COMPASS	
HNU CALIBRATION KIT	X
MONITOX CN METER	X
GCA/MDA PARTICULATE MONITOR	X

FIRST AID EQUIPMENT

FIRST AID KIT	X
OXYGEN ADMINISTRATOR	
STRECHER	
PORTABLE EYE WASH	X
BLOOD PRESSURE MONITOR	X
RADIATION BADGES	X
FIRE EXTINGUISHER	X
THERMOMETERS (OVAL)	X

DECON EQUIPMENT

WASH TUBS	X
BUCKETS	X
SCRUB BRUSHES	X
PRESSURIZED SPRAYER	X
DETERGENT (TYPE TSP)	X
SOLVENT (TYPE HEXANE)	X
~~ACETONE~~	~~X~~

DECON EQUIPMENT (CONT.)

PLASTIC SHEETING	X
TARPS	X
TRASH BAGS	X
TRASH CANS	
MASKING TAPE	X
DUCT TAPE	X
PAPER TOWELS	X
FACE MASK	
FACE MASK SANITIZER	X
FOLDING CHAIRS	X
STEP LADDERS	

SAMPLING EQUIPMENT

To be determined	

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HAZARD EVALUATION OF CHEMICALS

Chemical Name 2,3,7,8 tetrachlorodibenzo- **Date** 10/8/85

DOT Name/U.N. No. None **Job No.** IL-3020

CAS Number 1746-01-6

References Consulted (circle):

NIOSH/OSHA Pocket Guide (Verschueren) (Merck Index) Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: RTECS

Chemical Properties: (Synonyms: Dioxin, TCDD)

Chemical Formula $C_{12}H_4O_2Cl_4$ **Molecular Weight** 322 sfw

Physical State Crystalline solid **Solubility (H_2O)** 0.2 **Boiling Point** Decomposes at >1292°F

Flash Point N/A **Vapor Pressure/Density** 1.7×10^{-6} **Freezing Point** N/A

Specific Gravity 1.075 @ 25°C **Odor/Odor Threshold** -- @ 770°F **Flammable Limits** N/A

Incompatibilities Unknown

Biological Properties:

TLV-TWA Not established **PEL** Not established **Odor Characteristic** --

IDLH 22,500 ng/kg **Human** -- **Aquatic** -- **Rat/Mouse** Oral LD_{50} = 22 ug/kg

Route of Exposure Dermal, inhalation, ingestion

Carcinogen Suspected **Teratogen** Animal (RTECS) **Mutagen** Positive (RTECS)

EPA/CDC level in soil is 1 ppb

Handling Recommendations: (Personal protective measures)

Supplied air suggested, coated, chemically resistant coveralls, butyl or neoprene boots and gloves. Avoid all contact with skin.

Monitoring Recommendations:

Monitor for dust in the air.

Disposal/Waste Treatment:

Remove from environment and store safely until an approved disposal site can be located (store in sealed, non-reusable containers).

Health Hazards and First Aid: Eyes: Wash immediately with copious amounts of water. Skin: Wash with soap or mild detergent and water. Inhalation: Remove to fresh air (AR if necessary). Ingestion: Give water, then induce vomitting.

Symptoms:

Acute: Chloracne, skin and eye irritation, fatigue, respiratory distress, mental depression.

Chronic: Chloracne, hepatic neurosis, hemmorrhage, emphysema, liver, thyroid, skin, and kidney carcinogens. CNS depression.

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(12/83,CLD)

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VAN EQUIPMENT		MISCELLANEOUS (CONT.)	
TOOL KIT	___	BINOCULARS	___
HYDRAULIC JACK	___	MEGAPHONE	___
LUG WRENCH	___	___	___
TOW CHAIN	___	___	___
VAN CHECK OUT	___	___	___
GAS	___	___	___
OIL	___	___	___
ANTIFREEZE	___	___	___
BATTERY	___	___	___
WINDSHIELD WASH	___	___	___
TIRE PRESSURE		___	___
___	___	___	___
___	___	___	___
___	___	___	___
MISCELLANEOUS		___	___
PITCHER PUMP	___	___	___
SURVEYOR'S TAPE	X	___	___
100 FIBERGLASS TAPE	___	___	___
300 NYLON ROPE	___	___	___
NYLON STRING	___	___	___
SURVEYING FLAGS	___	___	___
FILM	X	___	___
WHEEL BARROW	___	___	___
BUNG WRENCH	___	___	___
SOIL AUGER	___	___	___
PICK	___	___	___
SHOVEL	___	___	___
CATALYTIC HEATER	___	___	___
PROPANE GAS	___	___	___
BANNER TAPE	X	___	___
SURVEYING METER STICK	___	___	___
CHAINING PINS & RING	___	___	___
TABLES	___	___	___
WEATHER RADIO	X	___	___

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HAZARDOUS & TOXIC MATERIALS TEAM
SITE SAFETY REVIEW

GENERAL INFORMATION

DATE ____________ TIME ____________ JOB NO: ________

SITE: ______________________________

LOCATION: ______________________________

ONSITE CLIENT CONTACT: ______________________________

OBJECTIVES: ______________________________

TYPES OF CHEMICALS ANTICIPATED: ______________________________

MEETING CONDUCTED BY: ______________________________

TOPICS DISCUSSED

PHYSICAL HAZARDS: ______________________________

CHEMICAL HAZARDS: ______________________________

PERSONAL PROTECTION: ______________________________

DECONTAMINATION: ______________________________

SPECIAL SITE CONSIDERATIONS: ______________________________

____

____

____

CHECK LIST

1. Emergency information reviewed? and made familiar to all team members?

2. Route to nearest hospital driven and its location known to all team?

3. Site safety plan readily available and its location known to all team members? ____

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ON-SITE SAFETY MEETING

Project ______________________

Date ______________ Time ______________ Job No. ______________

Address ______________________

Specific Location ______________________

Type of Work ______________________

____

____

SAFETY TOPICS PRESENTED

Protective Clothing/Equipment ______________________

____

Chemical Hazards ______________________

____

Physical Hazards ______________________

____

Emergency Procedures ______________________

____

Hospital/Clinic ______________ Phone ______________

Hospital Address ______________________

Special Equipment ______________________

____

Other ______________________

____

ATTENDEES

Name Printed	Signature

Meeting Conducted By: ______________ ______________

Name Printed Signature

Site Safety Officer ______________ Team Leader ______________

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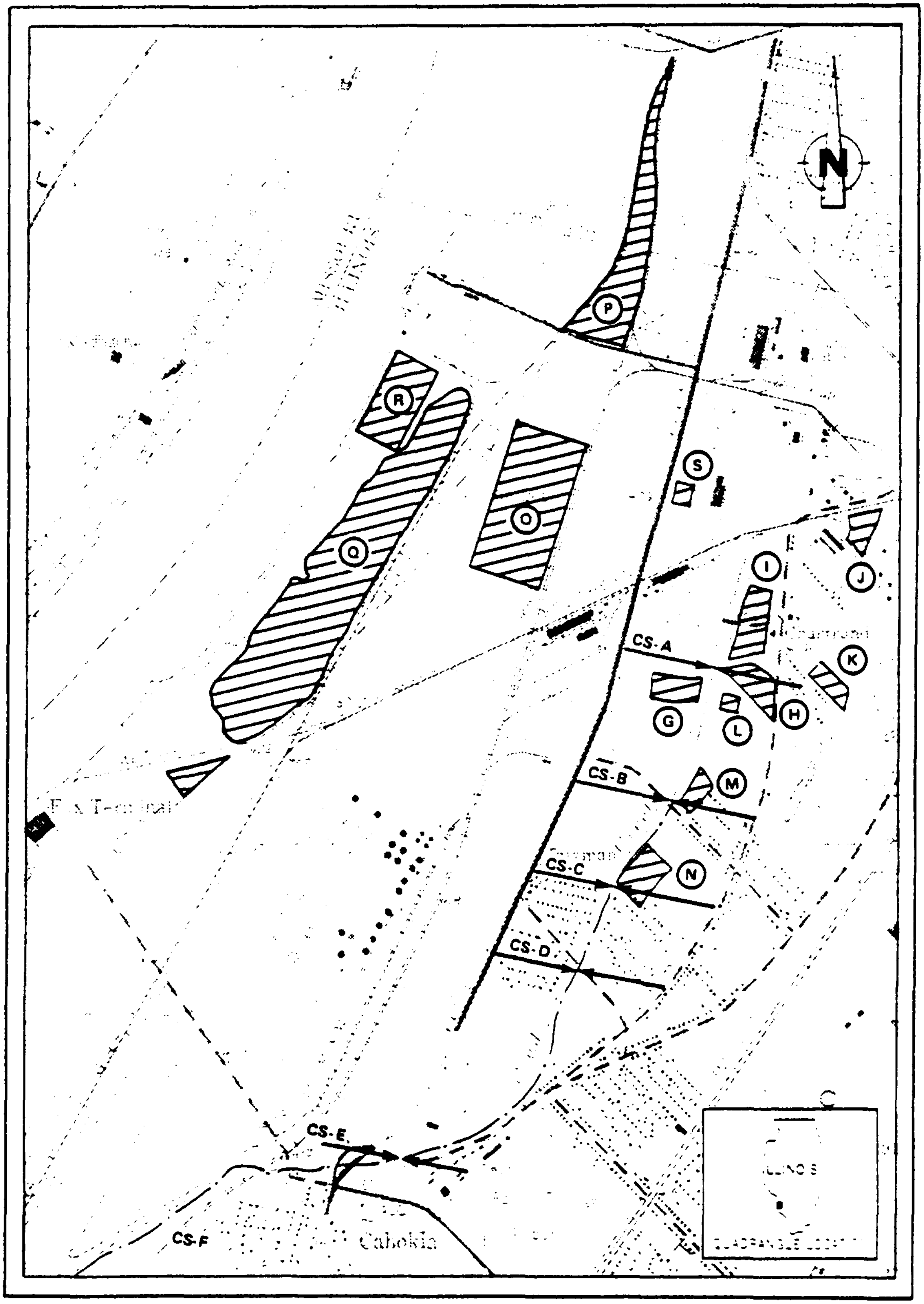

DEAD CREEK PROJECT AREA SITE LOCATION MAP

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HAZARD EVALUATION OF CHEMICALS

Chemical Name ____________________ Date ____________________

DOT Name/U.N. No. ____________________ Job No. ____________________

CAS Number ____________________

References Consulted (circle):

NIOSH/OSHA Pocket Guide Verschueren Merck Index Hazardline Chris (Vol. II)

Toxic and Hazardous Safety Manual ACGIH Other: ____________________

Chemical Properties: (Synonyms: ____)

Chemical Formula ____________________ Molecular Weight ____________________

Physical State ____________ Solubility (H_2O) ____________ Boiling Point ____________

Flash Point ____________ Vapor Pressure/Density ____________ Freezing Point ____________

Specific Gravity ____________ Odor/Odor Threshold ____________ Flammable Limits ____________

Incompatabilities ____

Biological Properties:

TLV-TWA ____________ PEL ____________ Odor Characteristic ____________

IDLH ____________ Human ____________ Aquatic ____________ Rat/Mouse ____________

Route of Exposure ____

Carcinogen ____________ Teratogen ____________ Mutagen ____________

Handling Recommendations: (Personal protective measures)

____

____

Monitoring Recommendations:

____

____

Disposal/Waste Treatment:

____

____

Health Hazards and First Aid:

____

____

Symptoms: Acute: ____

____

Chronic: ____

____

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(12/83,OLD)

AST	ARSENIC TRICHLORIDE

Common Synonyms	Liquid	Colorless	Unpleasant odor
Fuming liquid arsenic Arsenic (III) trichloride Arsenic chloride Arsenous chloride Caustic arsenic chloride	Sinks and reacts in water. Poisonous visible vapor cloud is produced		

AVOID CONTACT WITH LIQUID AND VAPOR. KEEP PEOPLE AWAY
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Not Flammable POISONOUS GASES ARE PRODUCED WHEN HEATED
 **Exposure**	CALL FOR MEDICAL AID VAPOR POISONOUS IF INHALED Move victim to fresh air. If breathing is difficult, give oxygen. LIQUID POISONOUS IF SWALLOWED. Irritating to skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE
(See Response Methods Handbook, CG 446-4)

Issue warning – poison, water contaminant, corrosive
Restrict access
Disperse and flush

2. LABEL

3. CHEMICAL DESIGNATIONS
3.1 **Synonyms:** Arsenic (III) trichloride, Arsenic chloride, Arsenous chloride, Arsenious chloride, Butter of arsenic, Caustic arsenic chloride, Caustic oil of arsenic, Fuming liquid arsenic
3.2 **Coast Guard Compatibility Classification:** Not applicable
3.3 **Chemical Formula:** $AsCl_3$
3.4 **IMCO/United Nations Numerical Designation:** 6.1/1560

4. OBSERVABLE CHARACTERISTICS
4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Acrid

5. HEALTH HAZARDS
5.1 **Personal Protective Equipment:** Safety goggles and face shield, acid-type canister gas mask, rubber gloves, protective clothing
5.2 **Symptoms Following Exposure:** Inhalation causes irritation of nose and throat. Contact of liquid with eyes or skin causes severe irritation. Ingestion causes weakness and severe irritation of mouth and stomach. Overdose can cause arsenic poisoning, but symptoms are delayed
5.3 **Treatment for Exposure:** Get medical attention after all exposures to the compound. Be alert for arsenic poisoning symptoms. INHALATION: remove to fresh air, give artificial respiration if needed. EYES: flush with water for at least 15 min. SKIN: flush with water. INGESTION: give large amounts of water, then induce vomiting, give lime water, milk, or raw egg, give a cathartic
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 0.5 mg/m³ as arsenic
5.5 **Short-Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 3; oral rat LD_{50} = 138 mg/kg, fatal human dose 70-180 mg depending on weight
5.7 **Late Toxicity:** Arsenic compounds may be carcinogenic
5.8 **Vapor (Gas) Irritant Characteristics:** Data not available
5.9 **Liquid or Solid Irritant Characteristics:** Data not available
5.10 **Odor Threshold:** Data not available

6. FIRE HAZARDS
6.1 **Flash Point:** Not flammable
6.2 **Flammable Limits in Air:** Not flammable
6.3 **Fire Extinguishing Agents:** Not pertinent
6.4 **Fire Extinguishing Agents Not to be Used:** Avoid water on adjacent fires
6.5 **Special Hazards of Combustion Products:** Irritating and toxic hydrogen chloride formed when involved in fire
6.6 **Behavior in Fire:** Becomes gaseous and causes irritation. Forms hydrogen chloride (hydrochloric acid) by reaction with water used on adjacent fires
6.7 **Ignition Temperature:** Not pertinent
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not pertinent

7. CHEMICAL REACTIVITY
7.1 **Reactivity with Water:** Reacts with water to generate hydrogen chloride (hydrochloric acid)
7.2 **Reactivity with Common Materials:** Corrodes metal
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Flush with water, rinse with sodium bicarbonate or lime solution
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION
8.1 **Aquatic Toxicity:** Data not available
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** Data not available
8.4 **Food Chain Concentration Potential:** None

9. SELECTED MANUFACTURERS
1. Cerac Inc.
   13460 W. Silver Spring Rd.
   Menomonee Falls, Wis. 5305
2. Ventron Corporation
   Alfa Products
   P. O. Box 159
   Beverly, Mass. 01915
3. Gallard Schlesinger Chemical Manufacturing Co.
   584 Mineola Avenue
   Carle Place, N. Y. 11514

10. SHIPPING INFORMATION
10.1 **Grades or Purity:** Commercial
10.2 **Storage Temperature:** Ambient
10.3 **Inert Atmosphere:** No requirement
10.4 **Venting:** Pressure-vacuum

11. HAZARD ASSESSMENT CODE
(See Hazard Assessment Handbook, CG 446-3)

A-O

12. HAZARD CLASSIFICATIONS
12.1 **Code of Federal Regulations:** Poisonous, Class B
12.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
12.3 **NFPA Hazard Classification:** Not listed

13. PHYSICAL AND CHEMICAL PROPERTIES
13.1 **Physical State at 15°C and 1 atm:** Liquid
13.2 **Molecular Weight:** 181.3
13.3 **Boiling Point at 1 atm:** 266.4°F = 130.2°C = 403.4°K
13.4 **Freezing Point:** 9°F = −13°C = 260°K
13.5 **Critical Temperature:** Not pertinent
13.6 **Critical Pressure:** Not pertinent
13.7 **Specific Gravity:** 2.156 at 25°C (liquid)
13.8 **Liquid Surface Tension:** (est.) 20 dynes/cm = 0.020 N/m at 20°C
13.9 **Liquid-Water Interfacial Tension:** Not pertinent
13.10 **Vapor (Gas) Specific Gravity:** Not pertinent
13.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
13.12 **Latent Heat of Vaporization:** 88.31 Btu/lb = 49.06 cal/g = 2.054 × 10⁵ J/kg
13.13 **Heat of Combustion:** Not pertinent
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** (est.) −18 Btu/lb = −10 cal/g = −0.42 × 10⁵ J/kg
13.16 **Heat of Polymerization:** Not pertinent

(Continued on pages 3 and 4)

NOTES

Draft

P-CHLOROTOLUENE

[redacted] ON SYNONYMS
[redacted] chloride
[redacted] 1-methylbenzene
[redacted] methane

Liquid — Colorless

Sinks slowly in water

[redacted] contact with liquid. Keep people away.
[redacted] goggles and self-contained breathing apparatus.
[redacted] discharge if possible. Call fire department.
[redacted] and remove discharged material.
[redacted] local health and pollution control agencies.

[redacted] FIRE

COMBUSTIBLE

Wear goggles and self-contained breathing apparatus.
Extinguish with alcohol foam, carbon dioxide or dry chemical.

[redacted] POSURE

CALL FOR MEDICAL AID

LIQUID

Irritating to skin and eyes.
Harmful if swallowed.

Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and induce vomiting.

[redacted] ATER [redacted] LUTION

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

[redacted] Response Methods Handbook, CG 446-4)
[redacted] ect access
[redacted] and physical treatment.
[redacted] ure and flush

2. LABELS

No hazard label required by Code of Federal Regulations

3. CHEMICAL DESIGNATIONS

[redacted] ONYMS: 4-Chloro-1-methylbenzene
[redacted] Tolyl chloride; 1-Chloro-4-methylbenzene
[redacted] OAST GUARD COMPATIBILITY
[redacted] SIFICATION: Halogenated compound
[redacted] CAL FORMULA: C_7H_7Cl
[redacted] O/UNITED NATIONS NUMERICAL
[redacted] GNATION: Not listed

4. OBSERVABLE CHARACTERISTICS

4.1 PHYSICAL STATE (AS SHIPPED): Liquid
4.2 COLOR: Colorless
4.3 ODOR: Characteristic

5. HEALTH HAZARDS

[redacted] SONAL PROTECTIVE EQUIPMENT: Respirator with proper filter, goggles
[redacted] PTOMS FOLLOWING EXPOSURE: INHALATION: Irritation of respiratory system. EYES AND
[redacted] SKIN: Severe irritation. INGESTION: Severe internal damage if swallowed.
[redacted] EATMENT FOR EXPOSURE: Get medical aid. INHALATION: Move to fresh air. Remove
[redacted] minated clothing. Keep warm and quiet. If breathing has stopped give artificial respiration.
[redacted] EYES AND SKIN: Wash with plenty of water. INGESTION: Give one or two glasses of water or
[redacted] milk. Induce vomiting. Give cathartics.
[redacted] OXICITY BY INHALATION (THRESHOLD LIMIT VALUE): Data not available
[redacted] ORT TERM INHALATION LIMITS: Data not available
[redacted] OXICITY BY INGESTION: Data not available
[redacted] ATE TOXICITY: Data not available
[redacted] POR (GAS) IRRITANT CHARACTERISTICS: Data not available
[redacted] QUID OR SOLID IRRITANT CHARACTERISTICS: Data not available.
[redacted] OR THRESHOLD: Data not available

6. FIRE HAZARDS

6.1 FLASH POINT: Data not available
6.2 FLAMMABLE LIMITS IN AIR: Data not available
6.3 FIRE EXTINGUISHING AGENTS: Alcohol foam, CO_2, Dry chemical
6.4 FIRE EXTINGUISHING AGENTS NOT TO BE USED: Data not available
6.5 SPECIAL HAZARDS OF COMBUSTION PRODUCTS: Data not available
6.6 BEHAVIOR IN FIRE: Not pertinent
6.7 IGNITION TEMPERATURE: Data not available
6.8 ELECTRICAL HAZARD: Data not available
6.9 BURNING RATE: Data not available

7. CHEMICAL REACTIVITY

7.1 REACTIVITY WITH WATER: Data not available
7.2 REACTIVITY WITH COMMON MATERIALS: Data not available
7.3 STABILITY DURING TRANSPORT: Data not available
7.4 NEUTRALIZING AGENTS FOR ACIDS AND CAUSTICS: Data not available
7.5 POLYMERIZATION: Data not available
7.6 INHIBITOR OF POLYMERIZATION: Data not available

8. WATER POLLUTION

8.1 AQUATIC TOXICITY:
1-10 ppm/96 hour/Fathead/TLm
8.2 WATERFOWL TOXICITY: Data not available
8.3 BIOLOGICAL OXYGEN DEMAND (BOD): Data not available
8.4 FOOD CHAIN CONCENTRATION POTENTIAL: Data not available

9. SELECTED MANUFACTURERS

1. American Hoechst Corporation
   Industrial Chemicals Division
   Organic Intermediates Department
   Route 202-206
   N. Somerville, NJ 08876

2. Tenneco Chemicals, Inc.
   Turner Pl
   P.O. Box 365
   Piscataway, NJ 08854

10. SHIPPING INFORMATION

10.1 GRADES OR PURITY: Data not available
10.2 STORAGE TEMPERATURE: Data not available
10.3 INERT ATMOSPHERE: Data not available
10.4 VENTING: Data not available

11. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook, CG 446-3)

AX

12. HAZARD CLASSIFICATIONS

12.1 CODE OF FEDERAL REGULATIONS: Not listed
12.2 NAS HAZARD RATING FOR BULK WATER TRANSPORTATION: Not listed
12.3 NFPA HAZARD CLASSIFICATIONS

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	2
Reactivity (Yellow)	0

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 PHYSICAL STATE AT 15°C AND 1 ATM: Liquid
13.2 MOLECULAR WEIGHT: 126.6
13.3 BOILING POINT AT 1 ATM: 324°F = 162°C = 435.2°K
13.4 FREEZING POINT: 46.5°F = 7.50°C = 280.7°K
13.5 CRITICAL TEMPERATURE: Data not available
13.6 CRITICAL PRESSURE: Data not available
13.7 SPECIFIC GRAVITY: 1.0697 at 20°C
13.8 LIQUID SURFACE TENSION: 32.24 dynes/cm = 0.03224 N/m at 25°C
13.9 LIQUID-WATER INTERFACIAL TENSION: Data not available
13.10 VAPOR (GAS) SPECIFIC GRAVITY: 4.38 (estimated)
13.11 RATIO OF SPECIFIC HEATS OF VAPOR (GAS): Data not available
13.12 LATENT HEAT OF VAPORIZATION: At boiling point
136.8 Btu/lb = 76 cal/g = 3.18×10^5 J/kg
13.13 HEAT OF COMBUSTION: Data not available
13.14 HEAT OF DECOMPOSITION: Data not available
13.15 HEAT OF SOLUTION: Not pertinent
13.16 HEAT OF POLYMERIZATION: Data not available

NOTES

Draft

DBO	o-DICHLOROBENZENE

Common Synonyms: 1,2-Dichlorobenzene, Orthodichlorobenzene	Liquid	Colorless	Pleasant odor
	Sinks in water		

Avoid contact with liquid
Wear goggles and self-contained breathing apparatus
Stop discharge if possible
Call fire department
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire	Combustible POISONOUS GASES ARE PRODUCED IN FIRE Wear goggles and self-contained breathing apparatus Extinguish with water, dry chemical, foam, or carbon dioxide Cool exposed containers with water
Exposure	CALL FOR MEDICAL AID LIQUID Irritating to skin and eyes Harmful if swallowed Remove contaminated clothing and shoes Flush affected areas with plenty of water IF IN EYES, hold eyelids open and flush with plenty of water IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm
Water Pollution	Effect of low concentrations on aquatic life is unknown May be dangerous if it enters water intakes Notify local health and pollution control officials Notify operators of nearby water intakes

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook, CG 446-4)

Issue warning—water contaminant
Should be removed
Chemical and physical treatment

2. LABELS

No hazard label required by Code of Federal Regulations

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** 1,2-Dichlorobenzene; Dowtherm E; Orthodichlorobenzene
3.2 **Coast Guard Compatibility Classification:** Halogenated hydrocarbon
3.3 **Chemical Formula:** $o\text{-}C_6H_4Cl_2$
3.4 **IMCO/United Nations Numerical Designation:** 6.1/1591

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Colorless
4.3 **Odor:** Aromatic; characteristic aromatic

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Organic vapor-acid gas respirator, neoprene or vinyl gloves, chemical safety spectacles, face shield, rubber footwear, apron, protective clothing
5.2 **Symptoms Following Exposure:** Chronic inhalation of mist or vapors may result in damage to lungs, liver, and kidneys. Acute vapor exposure can cause symptoms ranging from coughing to central nervous system depression and transient anesthesia. Irritating to skin, eyes, and mucous membranes. May cause dermatitis.
5.3 **Treatment for Exposure:** INHALATION: remove victim to fresh air, keep him quiet and warm and call a physician promptly. INGESTION: no known antidote; treat symptomatically; induce vomiting and get medical attention promptly. EYES AND SKIN: flush with plenty of water; get medical attention for eyes; remove contaminated clothing and wash before reuse.
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 50 ppm
5.5 **Short-Term Inhalation Limits:** 50 ppm for 15 min
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} 0.5 to 5 g/kg
5.7 **Late Toxicity:** Causes kidney and liver damage in rats. Effects unknown in humans.
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.
5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.
5.10 **Odor Threshold:** 4.0 ppm, 50 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** 165°F O.C.; 155°F C.C.
6.2 **Flammable Limits in Air:** 2.2%–9.2%
6.3 **Fire Extinguishing Agents:** Water, foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Irritating vapors including hydrogen chloride gas, chlorocarbons, chlorine
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** 1198°F
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** 1.3 mm/min

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** 13 ppm/*/marine plankton/no growth/salt water
*Time period not specified
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** <0.1% (theor.), 1/8 day
8.4 **Food Chain Concentration Potential:** Data not available

9. SELECTED MANUFACTURERS

1. Dow Chemical Co.
Midland, Mich. 48640
2. Monsanto Co.
Monsanto Industrial Chemicals Co.
800 North Lindbergh Blvd.
St. Louis, Mo. 63166
3. Standard Chlorine Chemical Co., Inc.
1015-25 Belleville Turnpike
Kearney, N. J. 07032

10. SHIPPING INFORMATION

10.1 **Grades or Purity:** Technical 99.5% min. dichlorobenzene (ratio ortho + para/meta 80 min.); Technical 85% orthodichlorobenzene, 14.0% paradichlorobenzene; Technical 80% ortho, 17% para, 2% meta; Pure: not less than 99.5% ortho, not more than 0.5% para
10.2 **Storage Temperature:** Data not available (Continued on page 4)

11. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook, CG 446-3)

A-X-Y

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** ORM-A
12.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	1
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	1
Water Pollution	
Human Toxicity	1
Aquatic Toxicity	3
Aesthetic Effect	2
Reactivity	
Other Chemicals	1
Water	0
Self-Reaction	0

12.3 **NFPA Hazard Classifications:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	2
Reactivity (Yellow)	0

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Liquid
13.2 **Molecular Weight:** 147.01
13.3 **Boiling Point at 1 atm:** 356.9°F = 180.5°C = 453.7°K
13.4 **Freezing Point:** 0.3°F = −17.6°C = 255.6°K
13.5 **Critical Temperature:** Not pertinent
13.6 **Critical Pressure:** Not pertinent
13.7 **Specific Gravity:** 1.306 at 20°C (liquid)
13.8 **Liquid Surface Tension:** 37 dynes/cm = 0.037 N/m at 20°C
13.9 **Liquid-Water Interfacial Tension:** (est.) 40 dynes/cm = 0.04 N/m at 20°C
13.10 **Vapor (Gas) Specific Gravity:** Not pertinent
13.11 **Ratio of Specific Heats of Vapor (Gas):** 1.080
13.12 **Latent Heat of Vaporization:** 115 Btu/lb = 63.9 cal/g = 2.68 × 10^5 J/kg
13.13 **Heat of Combustion:** −7969 Btu/lb = −4427 cal/g = −185.4 × 10^5 J/kg
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

(Continued on pages 3 and 4)

10. SHIPPING INFORMATION (Cont'd.)

10.3 **Inert Atmosphere:** Data not available
10.4 **Venting:** Data not available

Draft

DCP	2,4-DICHLOROPHENOL

Common Synonyms	Solid crystals · Colorless · Medicinal odor Sinks in water

Avoid contact with solid and dust. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

SOLID OR DUST
Will burn skin and eyes.
Poisonous if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE
(See Response Methods Handbook, CG-446-1)

Issue warning—water contaminant
Should be removed
Chemical and physical treatment

2. LABELS

No hazard label required by Code of Federal Regulations.

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** No common synonyms.
3.2 **Coast Guard Compatibility Classification:** Not applicable
3.3 **Chemical Formula:** $HOC_6H_3Cl_2$-2,4
3.4 **IMCO/United Nations Numerical Designation:** 6.1/2020

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Solid
4.2 **Color:** White
4.3 **Odor:** Strong medicinal

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Bureau of Mines approved respirator, rubber gloves, chemical goggles.
5.2 **Symptoms Following Exposure:** Tremors, convulsions, shortness of breath, inhibition of respiratory system.
5.3 **Treatment for Exposure:** Inhalation — rest; Ingestion — drink water, epsom salt solution.
5.4 **Toxicity by Inhalation (Threshold Limit Value):** Not pertinent
5.5 **Short-Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 2; LD_{50} 0.5 to 5 g/kg (rat)
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Not pertinent
5.9 **Liquid or Solid Irritant Characteristics:** Fairly severe skin irritant. May cause pain and second-degree burns after a few minutes' contact.
5.10 **Odor Threshold:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** 200°F O.C.; 237°F C.C.
6.2 **Flammable Limits in Air:** Data not available
6.3 **Fire Extinguishing Agents:** Water, foam, carbon dioxide, dry chemical
6.4 **Fire Extinguishing Agents Not to be Used:** Water or foam may cause frothing
6.5 **Special Hazards of Combustion Products:** Toxic gases can be evolved
6.6 **Behavior in Fire:** Solid melts and burns
6.7 **Ignition Temperature:** Data not available
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not pertinent

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction
7.2 **Reactivity with Common Materials:** May react vigorously with oxidizing materials
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
5 ppm/3 hours/rainbow trout/killed/fresh water
5 ppm/12 hours/bluegills/killed/fresh water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** 100%, 5 days
8.4 **Food Chain Concentration Potential:** Data not available

9. SELECTED MANUFACTURERS

1. Dow Chemical Co.
Midland, Mich. 48640
2. Monsanto Co.
Monsanto Industrial Chemicals Co.
800 North Lindbergh Blvd.
St. Louis, Mo. 63166

10. SHIPPING INFORMATION

10.1 **Grades or Purity:** Data not available
10.2 **Storage Temperature:** Data not available
10.3 **Inert Atmosphere:** Data not available
10.4 **Venting:** Data not available

11. HAZARD ASSESSMENT CODE
(See Hazard Assessment Handbook, CG-446-3)

11

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** Not listed
12.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
12.3 **NFPA Hazard Classification:** Not listed

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Solid
13.2 **Molecular Weight:** 163.01
13.3 **Boiling Point at 1 atm:** 421°F = 216°C = 489°K
13.4 **Freezing Point:** 110°F = 45°C = 318°K
13.5 **Critical Temperature:** Not pertinent
13.6 **Critical Pressure:** Not pertinent
13.7 **Specific Gravity:** 1.40 at 15°C (solid)
13.8 **Liquid Surface Tension:** Not pertinent
13.9 **Liquid-Water Interfacial Tension:** Not pertinent
13.10 **Vapor (Gas) Specific Gravity:** Not pertinent
13.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
13.12 **Latent Heat of Vaporization:** Not pertinent
13.13 **Heat of Combustion:** Not pertinent
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

(Continued on pages 5 and 6)

NOTES

PCP | PENTACHLOROPHENOL

Common Synonyms	
Dowicide 7 Penta Santophen 20	Solid beads or flakes. White to light brown Sinks in water

Avoid contact with solid and dust. Keep people away.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Not flammable
 **Exposure**	CALL FOR MEDICAL AID DUST Irritating to eyes, nose and throat. If inhaled, will cause coughing or difficult breathing. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. SOLID POISONOUS IF SWALLOWED Will burn skin and eyes. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook, CG-446-4)

Issue warning - poison
Restrict access
Should be removed

2. LABELS

No hazard label required by Code of Federal Regulations

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** Dowicide 7
Penta
Santophen 20
3.2 **Coast Guard Compatibility Classification:** Not applicable
3.3 **Chemical Formula:** C_6Cl_5OH
3.4 **IMCO/United Nations Numerical Designation:** 6.1/2020

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Solid
4.2 **Color:** Colorless to light brown
4.3 **Odor:** Very weak

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Respirator for dust; goggles; protective clothing
5.2 **Symptoms Following Exposure:** Dust or vapor irritates skin and mucous membranes, causing coughing and sneezing. Ingestion causes loss of appetite, respiratory difficulties, anesthesia, sweating, coma. Overexposure can cause death.
5.3 **Treatment for Exposure:** Call a doctor! INGESTION: induce vomiting at once. EYES: flush with water for 15-30 min. SKIN: wash well with soap and water.
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 0.5 mg/m³
5.5 **Short-Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 3; LD_{50} 50 to 500 mg/kg (rat)
5.7 **Late Toxicity:** Data not available
5.8 **Vapor (Gas) Irritant Characteristics:** Vapor is moderately irritating such that personnel will not usually tolerate moderate or high vapor concentrations.
5.9 **Liquid or Solid Irritant Characteristics:** Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.
5.10 **Odor Threshold:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** Not flammable
6.2 **Flammable Limits in Air:** Not flammable
6.3 **Fire Extinguishing Agents:** Not pertinent
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Generates toxic and irritating vapors
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** Not flammable
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not flammable

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
5 ppm/3 hr/trout/lethal/fresh water
8.2 **Waterfowl Toxicity:** 4500 ppm/LC_{50}/mallards
8.3 **Biological Oxygen Demand (BOD):** Data not available
8.4 **Food Chain Concentration Potential:** Data not available

9. SELECTED MANUFACTURERS

1. Dow Chemical Co.
Midland, Mich. 48640
2. Reichold Chemicals, Inc.
RCI Bldg.
White Plains, N. Y. 10602
3. Sonford Chemical Co.
Port Neches, Tex. 77651

10. SHIPPING INFORMATION

10.1 **Grades or Purity:** 86-100%
10.2 **Storage Temperature:** Ambient
10.3 **Inert Atmosphere:** No requirement
10.4 **Venting:** Open

11. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook, CG-446-3)

11

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** Not listed
12.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
12.3 **NFPA Hazard Classifications:**

Category	Classification
Health Hazard (Blue)	3
Flammability (Red)	0
Reactivity (Yellow)	0

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Solid
13.2 **Molecular Weight:** 266.35
13.3 **Boiling Point at 1 atm:**
590°F = 310°C = 583°K
13.4 **Freezing Point:**
370°F = 188°C = 461°K
13.5 **Critical Temperature:** Not pertinent
13.6 **Critical Pressure:** Not pertinent
13.7 **Specific Gravity:** 1.98 at 15°C (solid)
13.8 **Liquid Surface Tension:** Not pertinent
13.9 **Liquid-Water Interfacial Tension:** Not pertinent
13.10 **Vapor (Gas) Specific Gravity:** Not pertinent
13.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
13.12 **Latent Heat of Vaporization:** Not pertinent
13.13 **Heat of Combustion:** Not pertinent
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

(Continued on page 1 and 2)

NOTES

REVISED 1978

PCB — POLYCHLORINATED BIPHENYL

Common Synonyms: PCB, Chlorinated biphenyl, Aroclor

Oily liquid to solid powder — Light yellow liquid or white powder — Weak odor

Sinks in water

Stop discharge if possible. Keep people away.
Avoid contact with liquid and solid.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with water, foam, dry chemical, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID

LIQUID OR SOLID
Irritating to skin and eyes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook, CG 446-4)

Issue warning – water contaminant
Should be removed
Chemical and physical treatment

2. LABELS

No hazard label required by Code of Federal Regulations

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** Aroclor, Chlorinated biphenyl, Halogenated waxes, PCB, Polychloropolyphenyls
3.2 **Coast Guard Compatibility Classification:** Not applicable
3.3 **Chemical Formula:** $(C_6H_{5-n})Cl_n$
3.4 **IMCO/United Nations Numerical Designation:** Not listed

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid or solid
4.2 **Color:** Pale yellow (liquid), colorless (solid)
4.3 **Odor:** Practically odorless

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Gloves and protective garments
5.2 **Symptoms Following Exposure:** Acne from skin contact
5.3 **Treatment for Exposure:** SKIN: wash with soap and water
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 0.5 to 1.0 mg/m³
5.5 **Short-Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** Grade 2; oral rat LD_{50} = 3980 mg/kg
5.7 **Late Toxicity:** Causes chromosomal abnormalities in rats, birth defects in birds
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause severe irritation of eyes and throat and cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 **Liquid or Solid Irritant Characteristics:** Contact with skin may cause irritation
5.10 **Odor Threshold:** Data not available

6. FIRE HAZARDS

6.1 **Flash Point:** >284°F
6.2 **Flammable Limits in Air:** Data not available
6.3 **Fire Extinguishing Agents:** Water, foam, dry chemical, or carbon dioxide
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Irritating gases are generated in fires
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** Data not available
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Data not available

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
0.278 ppm/96 hr/bluegill/TL_m/fresh water
0.005 ppm/336-1080 hr/pinfish/TL_m/salt water
8.2 **Waterfowl Toxicity:** LD_{50} 2000 ppm (mallard duck)
8.3 **Biological Oxygen Demand (BOD):** Very low
8.4 **Food Chain Concentration Potential:** High

9. SELECTED MANUFACTURERS

Monsanto Industrial Chemicals Co.
800 North Lindbergh Blvd.
St. Louis, Mo. 63166

10. SHIPPING INFORMATION

10.1 **Grades or Purity:** 11 grades (some liquid, some solids) which differ primarily in their chlorine content (20-68% by weight)
10.2 **Storage Temperature:** Ambient
10.3 **Inert Atmosphere:** No requirement
10.4 **Venting:** Open

11. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook, CG 446-3)

II

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** Not listed
12.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
12.3 **NFPA Hazard Classification:** Not listed

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Solid or liquid
13.2 **Molecular Weight:** Not pertinent
13.3 **Boiling Point at 1 atm:** Very high
13.4 **Freezing Point:** Not pertinent
13.5 **Critical Temperature:** Not pertinent
13.6 **Critical Pressure:** Not pertinent
13.7 **Specific Gravity:** 1.3-1.8 at 20°C (liquid)
13.8 **Liquid Surface Tension:** Not pertinent
13.9 **Liquid-Water Interfacial Tension:** Not pertinent
13.10 **Vapor (Gas) Specific Gravity:** Not pertinent
13.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
13.12 **Latent Heat of Vaporization:** Not pertinent
13.13 **Heat of Combustion:** Not pertinent
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

(Continued on pages 3 and 4)

NOTES

REVISED 1978

Draft

PHG	PHOSGENE

Common Synonyms
Carbonyl chloride

Liquefied compressed gas | Colorless gas or light yellow liquid | Sweet or sharp odor

Liquid sinks in water. Poisonous vapor is produced.
Boiling point is 47° F.

AVOID CONTACT WITH LIQUID AND VAPOR. Keep people away.
Wear goggles and self-contained breathing apparatus.
Stop discharge if possible.
Evacuate area in case of large discharge.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable.
POISONOUS GASES ARE PRODUCED WHEN HEATED.
Wear goggles and self-contained breathing apparatus.
Cool exposed containers and protect men effecting shutoff with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
POISONOUS IF INHALED.
Irritating to eyes, nose, and throat.
Effects may be delayed.
Move to fresh air.
If breathing has stopped, give artificial respiration (but NOT mouth-to-mouth).
If breathing is difficult, give oxygen.
Maintain absolute rest until medical aid arrives.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

See Response Methods Handbook, CG-446-4

Issue warning - poison
Restrict access
Evacuate area

2. LABEL

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** Carbonyl chloride; Chloroformyl chloride
3.2 **Coast Guard Compatibility Classification:** Not applicable
3.3 **Chemical Formula:** $COCl_2$
3.4 **IMCO/United Nations Numerical Designation:** 2.0/1076

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Compressed gas
4.2 **Color:** Colorless
4.3 **Odor:** Sharp, pungent odor in higher concentrations, like new-mown grass in low concentrations

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Approved U.S. Bureau of Mines respirator, protective clothing
5.2 **Symptoms Following Exposure:** Irritates lungs, causing delayed pulmonary edema. Slight gassing produces dryness or burning sensation in the throat, numbness, pain in the chest, bronchitis, and shortness of breath
5.3 **Treatment for Exposure:** INHALATION: remove victim from contaminated area, enforce absolute rest, call a doctor
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 0.1 ppm
5.5 **Short-Term Inhalation Limits:** 1 ppm for 5 min
5.6 **Toxicity by Ingestion:** Not pertinent
5.7 **Late Toxicity:** Severe delayed pulmonary edema
5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause severe irritation of eyes and throat and can cause eye and lung injury. They cannot be tolerated even at low concentrations.
5.9 **Liquid or Solid Irritant Characteristics:** Severe irritant to all tissues
5.10 **Odor Threshold:** 0.5 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** Not flammable
6.2 **Flammable Limits in Air:** Not flammable
6.3 **Fire Extinguishing Agents:** Water to cool containers
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Toxic gas is generated when heated
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** Not flammable
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not flammable

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** Decomposes, but not vigorously
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Can be absorbed in caustic soda solution. One ton of phosgene requires 2,400 lbs. of caustic soda dissolved in 1000 gal. of water
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** Data not available
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** None
8.4 **Food Chain Concentration Potential:** None

9. SELECTED MANUFACTURERS

1. Baschem Corp.
Mobay Chemical Co. Division
Penn Lincoln Pkwy., West
Pittsburg, Pa. 15205
2. E. I. duPont de Nemours & Co., Inc.
Elastomer Chemicals Dept.
Wilmington, Del. 19898
3. The Upjohn Co.
Polymer Chemicals Division
La Porte, Tex. 77571

10. SHIPPING INFORMATION

10.1 **Grades of Purity:** Commercial 99%
10.2 **Storage Temperature:** Ambient
10.3 **Inert Atmosphere:** No requirement
10.4 **Venting:** Safety relief

11. HAZARD ASSESSMENT CODE

See Hazard Assessment Handbook, CG-446-3

A-C-I-J-O

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** Poisonous gas or liquid, Class A
12.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
12.3 **NFPA Hazard Classifications:**

Category	Classification
Health Hazard (Blue)	4
Flammability (Red)	0
Reactivity (Yellow)	0

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Gas
13.2 **Molecular Weight:** 98.92
13.3 **Boiling Point at 1 atm:** 46.8°F = 8.2°C = 281.4°K
13.4 **Freezing Point:** −198°F = −128°C = 145°K
13.5 **Critical Temperature:** 360°F = 182°C = 455°K
13.6 **Critical Pressure:** 823 psia = 56.0 atm = 5.67 MN/m²
13.7 **Specific Gravity:** 1.38 at 20°C (liquid)
13.8 **Liquid Surface Tension:** 22.8 dynes/cm = 0.0228 N/m at 0°C
13.9 **Liquid-Water Interfacial Tension:** Not pertinent
13.10 **Vapor (Gas) Specific Gravity:** 3.4
13.11 **Ratio of Specific Heats of Vapor (Gas):** 1.170
13.12 **Latent Heat of Vaporization:** 110 Btu/lb = 59 cal/g = 2.5 × 10^5 J/kg
13.13 **Heat of Combustion:** Not pertinent
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

NOTES

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MCR — MERCURY

Common Synonyms	Liquid	Silver	Odorless
Quicksilver	Sinks in water		

AVOID CONTACT WITH LIQUID. Keep people away.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Not flammable

Exposure

CALL FOR MEDICAL AID.
LIQUID
Effects of exposure may be delayed.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.

Notify local health and wildlife officials.
Notify operators of nearby water intakes.

1. RESPONSE TO DISCHARGE

See Response Methods Handbook, CG 446-[illegible]

Should be removed
Chemical and physical treatment

2. LABELS

No hazard label required by Code of Federal Regulations

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** Quicksilver
3.2 **Coast Guard Compatibility Classification:** Not applicable
3.3 **Chemical Formula:** Hg
3.4 **IMCO/United Nations Numerical Designation:** Not listed

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquid
4.2 **Color:** Silvery
4.3 **Odor:** None

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Avoid contact of liquid with skin. For vapor use chemical cartridge (Hopcalite) respirator.
5.2 **Symptoms Following Exposure:** No immediate symptoms. As poisoning becomes established slight muscular tremor, loss of appetite, nausea, and diarrhea are observed. Psychic, kidney, and cardiovascular disturbances may occur.
5.3 **Treatment for Exposure:** Consult a doctor.
5.4 **Toxicity by Inhalation (Threshold Limit Value):** 0.05 mg/m³
5.5 **Short-Term Inhalation Limits:** Data not available
5.6 **Toxicity by Ingestion:** No immediate toxicity
5.7 **Late Toxicity:** Development of mercury poisoning
5.8 **Vapor (Gas) Irritant Characteristics:** None
5.9 **Liquid or Solid Irritant Characteristics:** None
5.10 **Odor Threshold:** Not pertinent

6. FIRE HAZARDS

6.1 **Flash Point:** Not flammable
6.2 **Flammable Limits in Air:** Not flammable
6.3 **Fire Extinguishing Agents:** Not pertinent
6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent
6.5 **Special Hazards of Combustion Products:** Not pertinent
6.6 **Behavior in Fire:** Not pertinent
6.7 **Ignition Temperature:** Not flammable
6.8 **Electrical Hazard:** Not pertinent
6.9 **Burning Rate:** Not flammable

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction
7.2 **Reactivity with Common Materials:** No reaction
7.3 **Stability During Transport:** Stable
7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent
7.5 **Polymerization:** Not pertinent
7.6 **Inhibitor of Polymerization:** Not pertinent

8. WATER POLLUTION

8.1 **Aquatic Toxicity:**
0.5–1 ppm/48 hr/carassius auratus/TLm/fresh water
0.29 ppm/48 hr/marine fish/TLm/salt water
8.2 **Waterfowl Toxicity:** Data not available
8.3 **Biological Oxygen Demand (BOD):** None
8.4 **Food Chain Concentration Potential:** Mercury concentrates in liver and kidneys of ducks and geese to levels above FDA limit of 0.5 ppm. Muscle tissue usually well below the limit.

9. SELECTED MANUFACTURERS

1. Belmont Smelting and Refining Works, Inc.
330 Belmont Ave.
Brooklyn, N.Y. 11207
2. Engelhard Minerals and Chemical Corp.
Philipp Bros. Division
299 Park Ave.
New York, N.Y. 10017
3. NL Industries
Goldsmith Division
900 W. 18th St.
Chicago, Ill. 60608

10. SHIPPING INFORMATION

10.1 **Grades of Purity:** Pure
10.2 **Storage Temperature:** Ambient
10.3 **Inert Atmosphere:** No requirement
10.4 **Venting:** Open

11. HAZARD ASSESSMENT CODE

See Hazard Assessment Handbook, CG 446-3

A-X

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** ORM-B
12.2 **NAS Hazard Rating for Bulk Water Transportation:** Not listed
12.3 **NFPA Hazard Classification:** Not listed

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Liquid
13.2 **Molecular Weight:** 200.59
13.3 **Boiling Point at 1 atm:** 675°F = 357°C = 630°K
13.4 **Freezing Point:** [illegible] = 234.[illegible]°K
13.5 **Critical Temperature:** 2664°F = 1462°C = 1735°K
13.6 **Critical Pressure:** 23,300 psia = 1587 atm = 160.8 MN/m²
13.7 **Specific Gravity:** [illegible] at 20°C (liquid)
13.8 **Liquid Surface Tension:** 470 dynes/cm = 0.470 N/m at 20°C
13.9 **Liquid-Water Interfacial Tension:** 375 dynes/cm = 0.375 N/m at 20°C
13.10 **Vapor (Gas) Specific Gravity:** Not pertinent
13.11 **Ratio of Specific Heats of Vapor (Gas):** Not pertinent
13.12 **Latent Heat of Vaporization:** Not pertinent
13.13 **Heat of Combustion:** Not pertinent
13.14 **Heat of Decomposition:** Not pertinent
13.15 **Heat of Solution:** Not pertinent
13.16 **Heat of Polymerization:** Not pertinent

NOTES

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VCM — VINYL CHLORIDE

Common Synonyms
Chloroethylene
VCL
Vinyl C Monomer

Liquefied compressed gas   Colorless   Sweet odor

Liquid floats and boils on water. Flammable, irritating visible vapor cloud is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Evacuate area in case of large discharge.
Avoid contact with liquid and vapor.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
POISONOUS GAS IS PRODUCED IN FIRE
Flashback along vapor trail may occur.
May explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Cool exposed containers and protect men effecting shutoff with water.
Stop flow of gas if possible.
Let fire burn.
Extinguish small fires with dry chemical.

Exposure

CALL FOR MEDICAL AID

VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will cause frostbite.
Flush affected areas with plenty of water.
DO NOT RUB AFFECTED AREAS

Water Pollution

Not harmful to aquatic life

1. RESPONSE TO DISCHARGE

(See Response Methods Handbook, CG-446-4)

Issue warning - high flammability
Evacuate area

2. LABEL

Red

3. CHEMICAL DESIGNATIONS

3.1 **Synonyms:** Chloroethene
Chloroethylene
Vinyl C Monomer
VCL
VCM

3.2 **Coast Guard Compatibility Classification:** Vinyl halides

3.3 **Chemical Formula:** $CH_2=CHCl$

3.4 **IMCO/United Nations Numerical Designation:** 2.0/1086

4. OBSERVABLE CHARACTERISTICS

4.1 **Physical State (as shipped):** Liquefied gas

4.2 **Color:** Colorless

4.3 **Odor:** Pleasant, sweet

5. HEALTH HAZARDS

5.1 **Personal Protective Equipment:** Rubber gloves and shoes, gas-tight goggles, organic vapor canister or self-contained breathing apparatus.

5.2 **Symptoms Following Exposure:** INHALATION: high concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate.

5.3 **Treatment for Exposure:** INHALATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops. EYES AND SKIN: flush with plenty of water for at least 15 min.; for eyes, get medical attention; remove contaminated clothing.

5.4 **Toxicity by Inhalation (Threshold Limit Value):** 200 ppm

5.5 **Short-Term Inhalation Limits:** 500 ppm for 5 min

5.6 **Toxicity by Ingestion:** Not pertinent

5.7 **Late Toxicity:** Chronic exposure may cause liver damage

5.8 **Vapor (Gas) Irritant Characteristics:** Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.

5.9 **Liquid or Solid Irritant Characteristics:** Minimum hazard. If spilled on clothing and allowed to remain, may cause smarting and reddening of skin. May cause frostbite.

5.10 **Odor Threshold:** 260 ppm

6. FIRE HAZARDS

6.1 **Flash Point:** -110°F O.C.

6.2 **Flammable Limits in Air:** 4%–26%

6.3 **Fire Extinguishing Agents:** For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water.

6.4 **Fire Extinguishing Agents Not to be Used:** Not pertinent

6.5 **Special Hazards of Combustion Products:** Forms highly toxic combustion products such as hydrogen chloride, phosgene and carbon monoxide.

6.6 **Behavior in Fire:** Container may explode in fire. Gas is heavier than air and may travel considerable distance to a source of ignition and flash back.

6.7 **Ignition Temperature:** 882°F

6.8 **Electrical Hazard:** Class I, Group D

6.9 **Burning Rate:** 4.3 mm/min

7. CHEMICAL REACTIVITY

7.1 **Reactivity with Water:** No reaction

7.2 **Reactivity with Common Materials:** No reaction

7.3 **Stability During Transport:** Stable

7.4 **Neutralizing Agents for Acids and Caustics:** Not pertinent

7.5 **Polymerization:** Polymerizes in presence of air, sunlight, or heat unless stabilized by inhibitors

7.6 **Inhibitor of Polymerization:** Not normally used except when high temperatures are expected. Then 40-100 ppm of phenol used.

8. WATER POLLUTION

8.1 **Aquatic Toxicity:** None

8.2 **Waterfowl Toxicity:** None

8.3 **Biological Oxygen Demand (BOD):** None

8.4 **Food Chain Concentration Potential:** None

9. SELECTED MANUFACTURERS

1. Dow Chemical Co.
Midland, Mich. 48640

2. The B. F. Goodrich Co.
6100 Oak Tree Blvd.
Cleveland, Ohio 44131

3. PPG Industries, Inc.
Chemical Division
Guayanilla, Puerto Rico 00656

10. SHIPPING INFORMATION

10.1 **Grades or Purity:** Commercial or technical 99+%

10.2 **Storage Temperature:**
Under pressure: ambient
At atm. pressure: low

10.3 **Inert Atmosphere:** No requirement

10.4 **Venting:**
Under pressure: safety relief
At atm. pressure: pressure-vacuum

11. HAZARD ASSESSMENT CODE

(See Hazard Assessment Handbook, CG-446-3)

A-B-C-D-E-F-G-Z

12. HAZARD CLASSIFICATIONS

12.1 **Code of Federal Regulations:** Flammable compressed gas

12.2 **NAS Hazard Rating for Bulk Water Transportation:**

Category	Rating
Fire	4
Health	
Vapor Irritant	2
Liquid or Solid Irritant	1
Poisons	2
Water Pollution	
Human Toxicity	0
Aquatic Toxicity	0
Aesthetic Effect	0
Reactivity	
Other Chemicals	2
Water	0
Self-Reaction	2

12.3 **NFPA Hazard Classifications:**

Category	Classification
Health Hazard (Blue)	2
Flammability (Red)	4
Reactivity (Yellow)	1

13. PHYSICAL AND CHEMICAL PROPERTIES

13.1 **Physical State at 15°C and 1 atm:** Gas

13.2 **Molecular Weight:** 62.50

13.3 **Boiling Point at 1 atm:** 7.2°F = -13.9°C = 259.4°K

13.4 **Freezing Point:** -244.8°F = -153.8°C = 119.4°K

13.5 **Critical Temperature:** 317.3°F = 158.4°C = 431.6°K

13.6 **Critical Pressure:** 775 psia = 52.7 atm = 5.34 MN/m²

13.7 **Specific Gravity:** 0.969 at -13°C (liquid)

13.8 **Liquid Surface Tension:** 16.0 dynes/cm = 0.0160 N/m at 25°C

13.9 **Liquid-Water Interfacial Tension:** (est.) 30 dynes/cm = 0.03 N/m at 20°C

13.10 **Vapor (Gas) Specific Gravity:** 2.2

13.11 **Ratio of Specific Heats of Vapor (Gas):** 1.186

13.12 **Latent Heat of Vaporization:** 160 Btu/lb = 88 cal/g = 3.7 x 10⁵ J/kg

13.13 **Heat of Combustion:** -8136 Btu/lb = -4520 cal/g = -189.1 x 10⁵ J/kg

13.14 **Heat of Decomposition:** Not pertinent

13.15 **Heat of Solution:** Not pertinent

13.16 **Heat of Polymerization:** -729 Btu/lb = -405 cal/g = -16.9 x 10⁵ J/kg

NOTES

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ecology and environment, inc.

ON-SITE SAFETY LOG

	Background Reading in Breathing Zone	Calibrated At	On-Site Reading in Breathing Zone
A. On-Site Monitoring			
1. HNU/OVA and calibration gas			
2. Rad-mini			
3. Monitox			
4. O_2/Explosimeter and calibration gas			
5. Dust monitor			

B. Protective Clothing Worn: ______________________

C. Site Name: Dead Creek Project   Project Number: ______________

Date: ______________

Weather Conditions: ______________

Name of Attendees at Site: ______________________

D. Comments on Monitoring or Protective Clothing: ______________________

	Name	Signature
Team Leader:	M. McCarrin	
Site Safety Officer:	D. Sewall	

HISTORY

The study area for the Dead Creek Project (DCP) consists of 18 sites in the towns of Sauget and Cahokia in St. Clair County, Illinois (see attached map). The Illinois EPA became aware of the problems in this area in 1980 when periodic smoldering of materials in a ditch (Dead Creek) was observed. Following an initial inspection, the agency received information that a local resident's dog had come in contact with wastes in the ditch and died of apparent chemical burns.

Historically, during World War II, the study area was heavily developed by industry to support the war effort. Due to this development and the geologic conditions in the area, open pit mining occurred in many areas to supply sand and gravel resources. Following the war, excess product was landfilled and covered in the numerous excavations. Wastes reported to have been buried in these excavations include phosgene gas and munitions in addition to organic and inorganic industrial wastes. The excavated areas were identified by the Illinois EPA from a series of past aerial photographs, and by a thermal infrared survey of the area.

The filling of past excavations was followed by utilization of Dead Creek as receiving water for effluent and surface drainage of various industries. The Illinois EPA performed a preliminary study of the area in 1980, finding excessive levels of organic and inorganic contaminants in and around the creek. Contaminants detected included: PCBs, aliphatic hydrocarbons, dichlorobenzene, lead, cadmium, and arsenic. During the Illinois EPA study, drillers were overcome by organic vapors while installing a monitoring well east of the creek and adjacent to a former seepage lagoon. Sampling of this well and the lagoon indicated high levels of the aforementioned contaminants.

Following World War II, chemical companies in the area returned to normal processes, including the manufacturing of defoliants, pesticides, and herbicides. From the mid-1950s to the early 1970s, the byproducts and wastes from these manufacturing processes were landfilled in the Site R and possibly Site Q areas (see map). Drilling and sampling by E & E in 1983 at Site Q indicated the presence of 63 of the 117 priority pollutants designated by the USEPA, including quantifiable levels of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). Dioxin was also detected in soil samples at Site O. Site P is an Illinois EPA-permitted landfill known to have accepted hazardous waste residues in violation of their permit.

DEAD CREEK

Site G (Inactive Site). Drums and pits observed on the surface. Appear to contain oily wastes (drums - unknown black cinder-like solid).

Contaminants detected in groundwater: PCB (1.0 ppb), chlorophenol (1,200 ppb), chlorobenzene (19 ppb), dichlorobenzene (25 ppb), dichlorophenol (890 ppb), phosphorus (9.4 ppm), and lead (.31 ppm); surface soils: arsenic (16 ppm), lead (2,000 ppm), and PCB (350 ppm).

Death profile from creek shows PCB ranging from 9,200 ppm at the surface to 54 ppm at 6 feet.

November 1985 - no readings above background with site entry equipment. Physical hazards - three or four pits with exposed drums, numerous areas mounded with buried drums, poison ivy.

Site H (Inactive Site). Former sand and gravel pit which was filled with construction debris and unknown wastes. Presently covered and well vegetated. Physical hazards - trip and fall. One downgradient well - PCB - 1.0 ppb. No surface soil sampling done. No pits, ponds, etc. on-site.

Site T (Active Plant Site). Cerro copper property. Holding lagoon on site was formerly head water per Dead Creek. Culvert under New Queeny Avenue was blocked sometime after 1950. G112 only groundwater monitoring point for the site - analysis indicates chlorobenzene and dichlorobenzene, along with metals. Soil samples from areas adjacent to the holding pond indicate PCB (0.3 ppm) and aliphatic hydrocarbons (26 ppm) along with dichlorobenzene (1.7 ppm). Also arsenic (95.8 ppm). Surface water samples from holding pond show: nickel (4.2 ppm), arsenic (0.58 ppm), zinc (30 ppm), PCB (28 ppm), aliphatic hydrocarbons (23,000 ppm).

Plant site: Level D with hardhat, safety glasses, necessary - presently no water in former holding pond. Sand and gravel pit identified from historical aerial photos now filled and covered (parking area for trailers).

Site J (Active Plant Site). Sterling Steel Castings. No previous study done. Aerial photos indicate possible disposal. From visual observation and conversation with plant operator, material disposed of consists of casting sand and slag. (Needs groundwater monitoring). Two pits exist on site approximately 30' deep. Two to three drums are evident along the sides. Site also has an inactive incinerator. Possible contaminants include epoxy resins, heavy metals.

Site K (Residential Commercial). No information exists for this site. Historical aerial photos indicate possible dumping. Presently, trailer homes and a small trucking company occupy the property.

Site L (Active Equipment Repair Site). Historical photos indicate a small surface impoundment once existed on the site (Wagganer Trucking). Wagganer was an industrial waste hauler - trucks cleaned on site discharge first into creek, then into impoundment. Wagganer specialized in hauling hazardous materials. Downgradient groundwater analysis: chlorophenol (19 ppb), and cyclohexane (120 ppb). Soils: PCB (5,200 ppm), trichlorobenzne (78 ppm), and hydrocarbons: (21,000 ppm). Presently, site is covered with cinders with no evidence of where the pit was situated.

Site M (Inactive Pit). Hall Const. Pit - site consists of an open pit used for dumping of unknown wastes. Surface soils: PCB, arsenic, and mercury. Surface water: PCB, phosphorus (low levels). Presently, pit is inside fence which surrounds Dead Creek between New Queeeny Avenue and Judith Lane. Steep sloping sides, water present in pit.

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Site N (Inactive Construction Site). No historical information is available for this site. Historical photos indicate possible disposal. Presently site is occupied by an inactive construction company. No previous studies performed.

Site O (Active STP). American Bottany wastewater treatment plant. Historically, three lagoons were used for sludge dewatering. Lagoon area is now covered and vegetated. Preliminary sampling indicates PCB, miscellaneous hydrocarbons. No field work proposed for initial phase of study.

Site P (Inactive Permitted Landfill). An IEPA permitted landfill known to have accepted hazardous residues in violation of their permit. Types and quantities of wastes recorded are unknown. No sampling has been done at the site. Presently municipal and construction debris (asbestos) are evident along with cinders, no drums evident. Site is still permitted, though no longer active.

Site Q (Inactive Landfill - Active Transport Facility). Consists of a former unpermitted landfill suspected of receiving hazardous wastes. Located adjacent to the Sauget Toxic Dump. E & E sampling (soil borings) indicated the presence of 63 priority pollutants, including 2378-TCAA. No groundwater monitoring has been done at the site - power lines traverse the entire area. Area covered entirely by black cinders. Some refuse (appliances, debris, etc.) randomly dumped in rear portion of property.

Site R (Inactive Landfill). Sauget Toxic Dump - Former chemical dump owned and operated by Monsanto. Contaminants detected in leachate include solvents and 2,3,7,8-TCAA (Tot sampling - 1981). Presently, site is well covered and vegetated. Monsanto tank farm for feedstocks located in the northern portion of the site. No drilling expected. Hard hat and safety glasses required by Monsanto.

PERSONAL PROTECTION

The purpose of this attachment is to outline the anticipated levels of protection for each of the objectives in the field investigation phase of this project. Upgrading and downgrading of these levels will be determined in the field based on our readings, weather conditions, and professional judgement. Minimum protective clothing to be worn by any task will include: neoprene boots (steel toe and shank), tyvek or saranax coveralls, disposable gloves and booties, hard hats, and neoprene gloves.

Subsurface Soil Sampling/Well Installation

The present scope of work includes collecting subsurface soil samples at sites G, H, I, J, K, L, and N. Well installation is scheduled for sites P, Q, and R.

The anticipated level of protection for collection of subsurface samples at sites G, H, I, and L is Level C. This will include racal power air-purifying respirators (APRs) in addition to the protective clothing listed above. It is expected that subsurface sampling at sites J, K, and N will be conducted in Level C. Monitoring with all equipment specified in the safety plan will take place during all drilling activities, and upgrades or downgrades in personal safety measures will be made as necessary. Hearing protection will be worn by personnel work on or near operating drill rig. It is anticipated that drilling and well installation at sites Q and R will be conducted in modified Level B protection. This will include the minimum protective clothing (saranac coveralls) along with self-contained air. Air will be supplied by an air compressor and run through a manifold system to separate air lines for each team member at the drill rig. The air compressor will be located upwind of drilling activities, and will be monitored to ensure proper breathing air is being supplied. Drilling and well installation at Site P will initially be conducted in Level C protection.

All levels of protection are based on existing background information. Upgrading and downgrading of these levels will be done in the field using best professional judgement, along with real-time instrumentation readings.

Surface Water/Sediment Sampling

Surface water samples will be collected from creek sectors A-F and Site M using a Kemmerer sampler or by dipping a wide-mouthed glass jar and collecting a grab sample. The anticipated level of protection for all surface water sampling is Level C, which will include racal power APRs along with the minimum protective clothing listed above. Viton or neoprene gloves, taped at the wrist, will also be worn.

Sediment samples will be collected from creek sectors C, D, E, F, and Site M using a peterson dredge or similar sampling device. The anticipated level of protection is as outlined above for surface water sampling. The need for upgrades or downgrades will be determined in the field using best professional judgement, along with real-time instrumentation readings.

Surface Soil Sampling

Surface soil samples will be collected from sites G, H, I, J, and N. Level C protection is anticipated to be sufficient for surface soil sampling at all sites listed. Racal power APRs will be worn in addition to the minimum protective clothing noted above. Upgrades will be determined in the field using best professional judgement, along with real-time instrumentation readings.

Groundwater Sampling

Groundwater samples will be collected from new monitoring wells at sites P, Q, and R; from existing monitoring wells in the vicinity of sites G, H, and L; and from residential wells to be determined.

Sampling of all monitoring wells is anticipated to be conducted in Level C protection. This will include racal power APRs and viton or neoprene gloves in addition to the minimum protective clothing. Residential well samples will be collected from existing plumbing in Level A protection. Upgrading and downgrading of these levels will be determined in the field as necessary, and downgrading will be cleared through the safety coordinator.

Soil Gas Monitoring/Air Investigation

Soil gas monitoring will be conducted at sites G, H, I, J, K, L, M, and N in addition to all creek sectors. The soil gas survey will consist of pounding a small diameter well point into the ground with a special cylindrical hammer, followed by pumping air from the well point into collection bags. Analysis of samples will then be completed using an OVA.

It is anticipated that all soil gas monitoring will be conducted in Level C protection, including racal power APRs in addition to the minimum protective clothing.

The air investigation will consist of surveying all sites to identify potential point sources. This will be followed by more detailed sampling of any "hot spots" encountered. All air investigations done in off-site areas are expected to be conducted in Level A protection as above, with upgrades to be determined in the field. On-site air investigations will be conducted in conjunction with other field activities (surface and subsurface soil sampling), and the level of protection will be as outlined above for these activities.

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APPENDIX D
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QUALITY ASSURANCE PROJECT PLAN
(QAPP)

DEAD CREEK PROJECT
SAUGET, ILLINOIS

FEBRUARY 1986

Prepared For:

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

Approved By:

______________________ E & E Quality Assurance Officer	Date:	______________
______________________ E & E Project Manager	Date:	______________
______________________ IEPA Region V Project Manager	Date:	______________
______________________ IEPA Region V Quality Assurance Officer	Date:	______________

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TABLE OF CONTENTS

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Table of Contents (Cont.)

Official copies and subsequent revisions will be delivered to:

Quality Assurance Officers

IEPA Region V	( )
E & E	A.P. Schuessler

Project Managers

IEPA Region V	J. Larson
E & E	M. Miller

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LIST OF ILLUSTRATIONS

LIST OF TABLES

1. INTRODUCTION

This Quality Assurance Project Plan (QAPP) presents the policies, organization, objectives, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities for the Dead Creek project in Sauget, Illinois. The purpose of the program is to ensure that all technical data generated are accurate, representative, and will ultimately withstand judicial scrutiny.

QC consists of a system of checks on field sampling and laboratory analysis (through the use of field blanks, duplicates, documentation of all sample movement, chain of custody records, etc.) to provide supporting information on the quality of the methods employed and the analytical data.

QA consists of overview checking to certify that the QC procedures have been properly implemented to produce accurate data. QA is a supervisory function.

All QA/QC procedures will be in accordance with applicable professional technical standards, United States Environmental Protection Agency (USEPA) requirements, government regulations and guidelines, and specific project goals and requirements. This QAPP is prepared in accordance with all Region V Illinois EPA (IEPA) and USEPA QAPP guidance documents.

The QAPP incorporates the following activities:

- Sample collection, control, chain-of-custody, and analysis;
- Document control;
- Laboratory instrumentation, analysis, and control; and
- Review of project deliverables.

Analytical samples will be collected in the field utilizing standard operating procedures (SOPs) and sent to Ecology and Environment, Inc.'s (E & E's) Analytical Services Center (ASC) for analysis. Duplicates, replicates, and spiked samples will be used to develop estimates of the quality of the analytical data. Field audits will be conducted to verify that proper sampling techniques and chain-of-custody procedures are followed. Field data compilation, tabulation, and analysis will be checked for accuracy. Calculations and other post-field tasks will be reviewed by project personnel.

Equipment used to take field measurements will be maintained and calibrated in accordance with established procedures (see Section 7). Records of calibration and maintenance will be kept by assigned personnel. Field testing and data acquisition will be performed in accordance with standard protocols.

Document control procedures will be used to coordinate the distribution, coding, storage, retrieval, and review of all data collected during the Dead Creek Project. These procedures will ensure safeguarding of any sensitive materials generated or obtained during the study.

2. PROJECT DESCRIPTION

This QAPP was prepared pursuant to the contract issued by the Illinois Environmental Protection Agency (IEPA) to Ecology and Environment, Inc., (E & E) to conduct a Remedial Investigation/ Feasibility Study (RI/FS) in the Dead Creek area in the towns of Sauget and Cahokia in St. Clair County, Illinois. The project area specifically includes various sites in the two towns that were used for industrial waste dumping or as landfills, as well as portions of Dead Creek--a stream that traverses through the project area before flowing into the Mississippi River. The project will be conducted in cooperation with the IEPA Division of Land Pollution Control.

The objective of the sampling and analysis of the Dead Creek Project Area is to define the nature and extent of contamination by investigating air quality, surface and subsurface soils, and groundwater, as well as surface water and sediments in Dead Creek. Sampling will be conducted in 18 areas: six sectors of Dead Creek, designated A through F, and 12 sites, designated G through R. The analytical data resulting from the RI will be used to prepare a Feasibility Study (FS) to determine if remedial actions are necessary and what level and types of actions are required to mitigate the contamination. The field work for the RI is expected to begin in the middle of March 1986 and be completed by the end of May 1986 (approximately 12 weeks).

Samples to be collected from the Dead Creek Project sites include:

- Surface soil samples;

- Subsurface soil samples (from borings);
- Groundwater samples; and
- Surface water/sediment samples.

In addition, air quality investigations will be conducted on a routine basis during on-site work. Soil gas measurements will be taken as necessary, but will not exceed 96 specific locations.

Table 2-1 provides a summary of the number of samples to be collected for each of the various sample media, at the various sites. The site locations are shown on Figure 2-1.

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Table 2-1

DEAD CREEK PROJECT SAMPLING FOR VARIOUS MEDIA

Sample Medium	Site	Sample Matrix	Number of Samples	Comments
Surface water/sediment	A	Water	3	Grab and composite
" "	B	"	3	" "
" "	C	Water/sediment	2/2	" "
" "	D	" "	1/2	" "
" "	E	" "	3/10	" "
" "	F	" "	4/10	" "
" "	M	" "	2/3	" "
" "	Field QC samples*	" "	5/6	" "
Surface soil	G	Soil	40	Grid (50 foot)
" "	H	"	5	Random
" "	I	"	32	Grid (100 foot)
" "	J	"	5	Random
" "	N	"	3	"
	O	"	10	Grid (100 foot)
" "	Field QC samples*	"	15	Random
Subsurface soil	G	Soil	10	Composite
" "	H	"	5	"
" "	I	"	15	"
" "	J	"	5	"
" "	K	"	3	"
" "	L	"	4	"
" "	N	"	2	"
" "	Field QC samples*	"	12	"
Groundwater	Existing monitoring wells	Water	12**	Assigned wells
"	Existing residential wells	"	5	" "
"	New monitoring wells	"	20	" "
"	Field QC samples for wells*	"	8	
Total Samples			199 soil/sediment 68 water 96 soil gas***	

*Field QC samples include one duplicate per 10 samples and one blank per day or per shipment if more than one shipment is made per day.

**Actual number of samples to be determined. Only 8 of 12 existing wells have been located. All wells need to be reconstructed prior to sampling.

***See Section 2.6 Soil Gas Survey for specific locations.

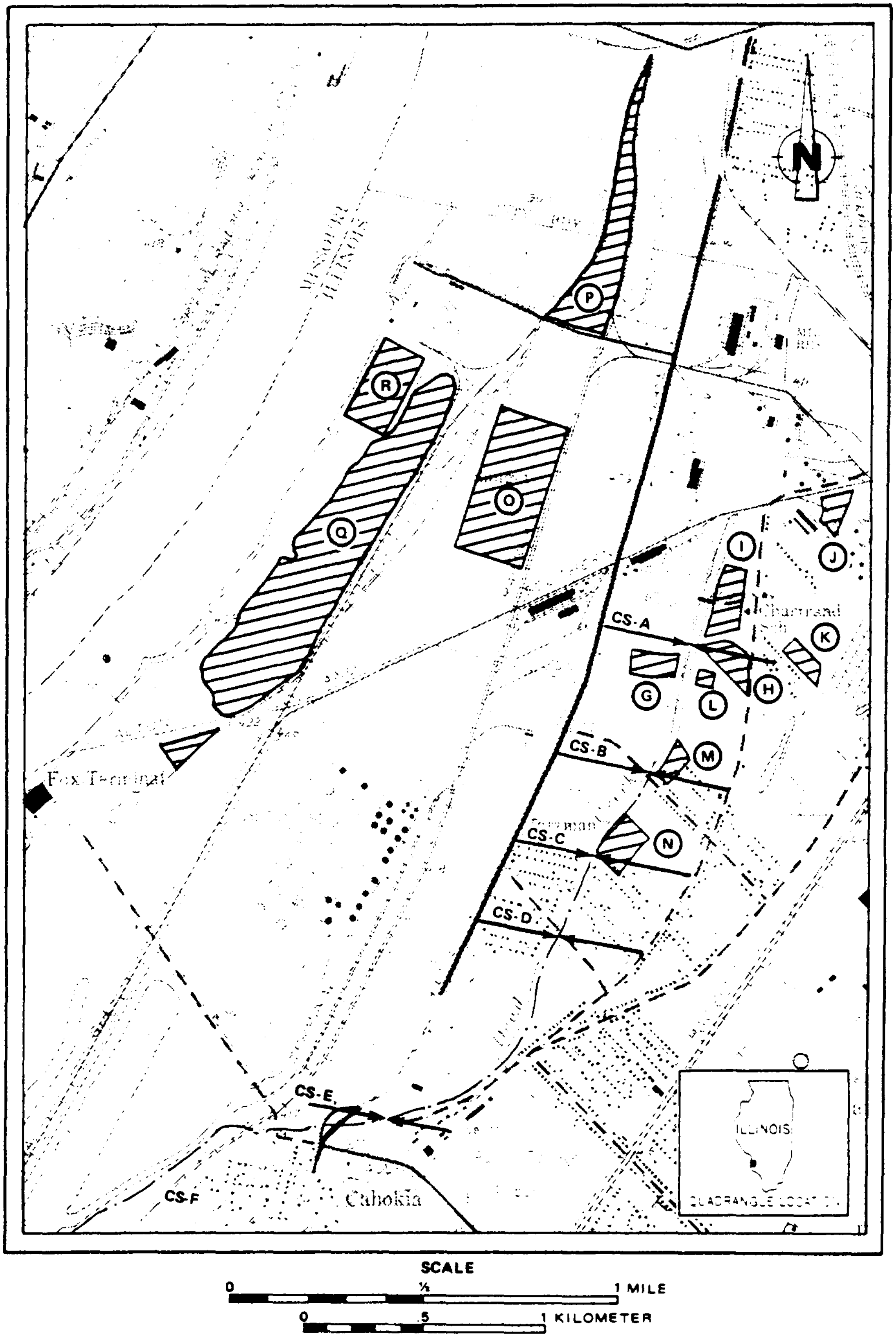

Figure 2–1 DEAD CREEK PROJECT AREA SITE LOCATION MAP

3. PROJECT ORGANIZATION AND RESPONSIBILITY

This QAPP provides for designated QA personnel to review products and provide guidance on QA/QC matters, and outlines the approach to be followed to assure that products of sufficient quality are obtained. In accordance with E & E's corporate QA program, experienced senior technical staff members will be assigned to project QA/QC functions. Figure 3-1 presents the program organization. Figure 3-2 presents the ASC management organization. The management structure provides for direct and constant operational responsibility, clear lines of authority, and the integration of QA activities. The various QA functions are explained below.

Project Management

The project management staff consists of IEPA Project Officer J. Larson and E & E project personnel G. Strobel, Project Director; M. Miller, Project Manager; and M. McCarrin, Assistant Project Manager. They are responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. Primary functions are to insure that technical, financial, and scheduling objectives are achieved successfully. With full responsibility and authority for project performance, they will:

- Define project objectives and develop a detailed work plan and schedule;

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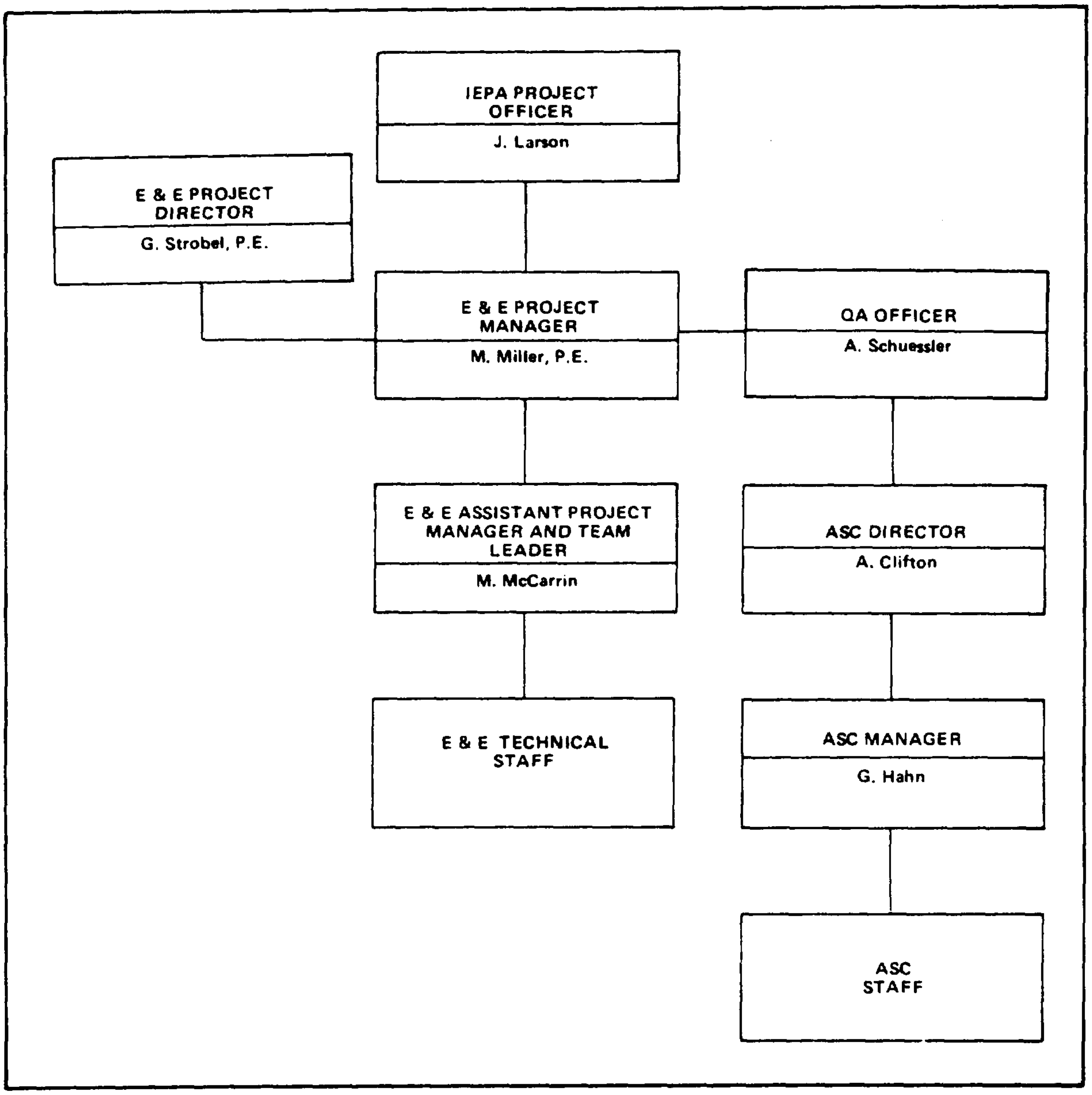

Figure 3–1 QUALITY ASSURANCE PROGRAM ORGANIZATION

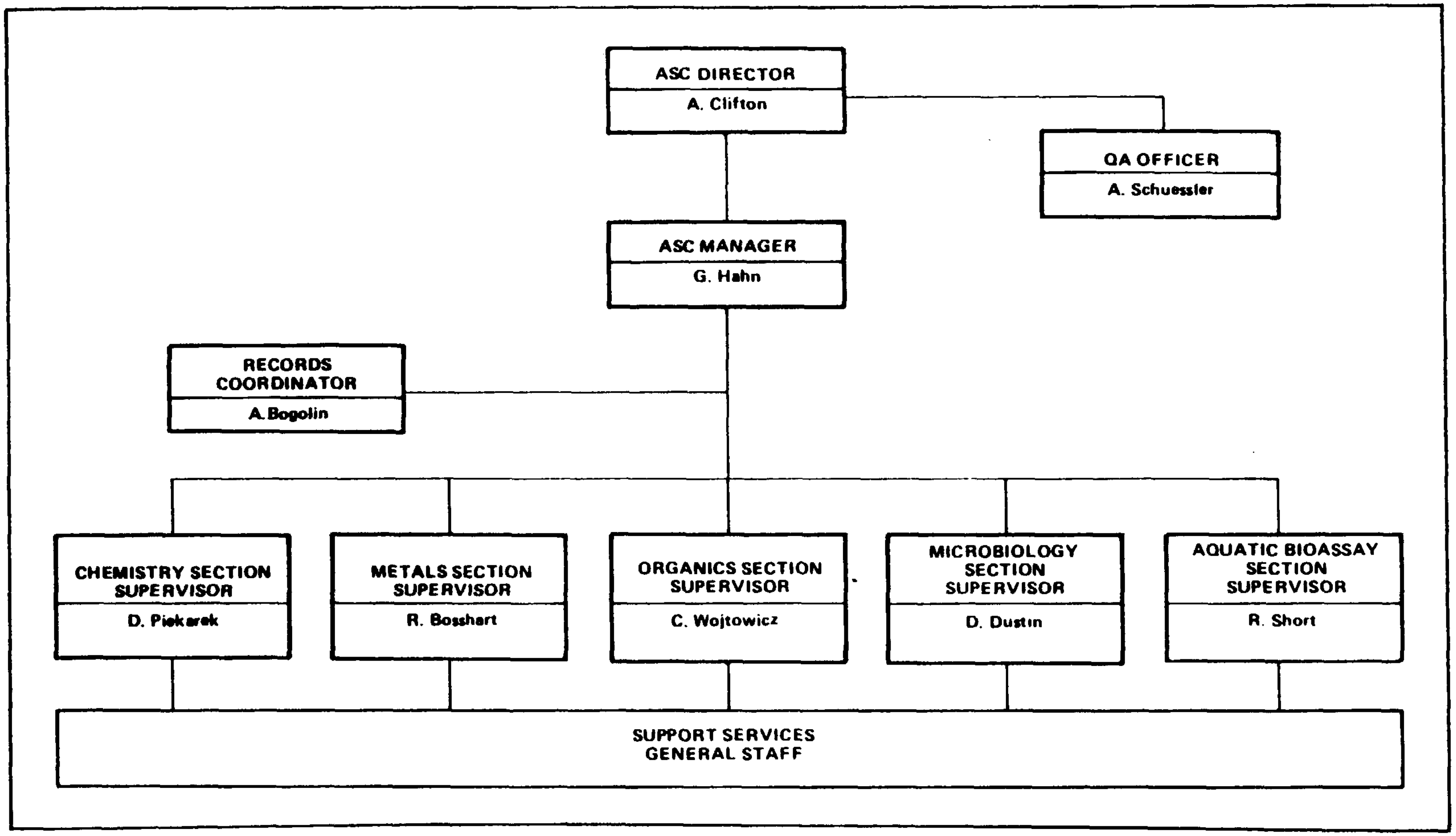

Figure 3–2 ANALYTICAL SERVICES CENTER MANAGEMENT ORGANIZATION

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- Establish project policy and procedures to address the specific needs of the Dead Creek project as a whole, as well as the objectives of each task;

- Acquire and apply technical, corporate, and/or subcontractor resources as needed to insure performance within budget and schedule constraints;

- Orient all team leaders and support staff concerning the project's special considerations;

- Monitor and direct the team leaders;

- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product;

- Review the work performed on each task to insure its quality, responsiveness, and timeliness;

- Review and analyze overall task performance with respect to planned requirements and authorizations;

- Approve all external Dead Creek project reports (deliverables) before their distribution;

- Ultimately be responsible for the preparation and quality of interim and final Dead Creek project reports; and

- Represent the project team at meetings and public hearings.

<u>Team Leader for Dead Creek Project</u>

The project managers will be supported by a field team leader who will be responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The team leader is a highly experienced environmental professional who will report directly to the project manager. The Team Leader and

Assistant Project Manager assigned to the project is M. McCarrin. Specific team leader responsibilities include:

- Provision of day-to-day coordination with the project manager on technical issues in specific areas of expertise;
- Development and implementation of team-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements;
- Coordination and management of team staff;
- Assure compliance with applicable TSCA and DOT regulations for samples requiring dioxin analysis;
- Implementation of QC for technical data provided by the team staff;
- Adherence to work schedules provided by the project manager;
- Authorship, review, and approval of text and graphics required for team efforts;
- Coordination of technical efforts of subcontractors assisting the team;
- Identification of problems at the team level, discussion of resolutions with the project manager, and provision of communication between team and upper management; and
- Participation in the preparation of the final report.

Technical Staff

The technical staff (team members) for this project will be drawn from E & E's pool of corporate resources and from the organizations of the various subcontractors associated with the project. The technical team staff will be utilized to gather data, analyze data, and prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

QA Project Officer

The QA project officer will be A. Schuessler. She is responsible for maintaining quality assurance for the Dead Creek Project. Specific functions and duties include:

- Coordinating client meetings to determine retention time of QA records, storage requirements and facilities, identification of QA records, and time of transfer of QA records to client facilities;

- Providing guidelines and information as required to assist the QA project managers in the planning, development, and implementation of the QA program for their specific projects;

- Assuring that records of investigatory tasks conform to applicable requirements prior to delivery to clients and assuring that necessary corrective actions have been taken;

- Assuring use of the latest approved procedures, checklists, and forms required to implement check or approval functions as may be specified by the appropriate regulatory agency or client; and

- Establishing a project review group to investigate potential nonconformance and corrective actions and recommend measures to prevent recurrence of any nonconformance.

Analytical Services Center (ASC) Director

The ASC director is A. Clifton. He is responsible for all analytical work and works in conjunction with the QA unit. He maintains liaison with the QA officer regarding QA and custody requirements. Specific duties include:

- Maintaining indexed master copies of all laboratory project records and final reports, listing for each project the equipment, instrument methods, nature of project, date project was initiated, current status, name of sponsor, name of project manager, and status of final report;

- Maintaining copies of the methods and safety manual;

- Conducting inspections of projects and keeping written records of the inspections. For projects lasting less than six months, the QA unit conducts at least one inspection. For projects lasting more than six months, inspections are conducted at least every three months;

- Submitting to the project director and the project managers written status reports on the project, noting any problems, recommendations, and corrective actions taken;

- Reviewing all final reports for accuracy; and

- Signing a statement specifying the dates on which QA inspections were made and findings were reported to management and to the project managers.

ASC Manager

The ASC Manager is G. Hahn. He maintains liaison with the ASC director regarding QA elements of specific sample analyses tasks. He reports to the ASC director and works in conjunction with the QA unit. Specific duties include:

- Developing project specific protocols with the laboratory director;

- Insuring that personnel clearly understand their required tasks;

- Insuring that the project is carried out in accordance with the protocol;

- Insuring that all project QA/QC methods are followed;

- Insuring that all data generated during a project are accurately recorded and verified;

- Insuring that any problems reported during the monitoring of a project by the QA unit are reported to the QA director and that corrective actions are taken and documented; and

- Insuring that project protocol, as well as the final report and all the supporting raw data, are transferred to suitable archives upon completion of the project.

ASC Staff

Each member of the ASC staff performs an assigned QA function that is pertinent to and within the scope of his or her knowledge, experience, training, and aptitude. An individual is assigned the responsibility for checking, reviewing, or otherwise verifying that a sample analysis activity has been correctly performed. The following is a breakdown of analytical areas and their assigned personnel.

- GC/MS: Caryn Wojtowicz - Supervisor; Mike Scanlon, Cindy Stempniak, and Lynn Sullivan - Analysts.

- GC: Caryn Wojtowicz - Supervisor; and David Willy - Analyst.

- Metals: Bob Bosshart - Supervisor; Jim Olka and Richard Nagler - Analysts.

- General/Wet: Dietmar Piekarek - Supervisor; and Paul Azzopardi - Technician.

ASC Facilities

E & E maintains a certified chemical and biological laboratory (the ASC) staffed by full-time scientists and technicians and equipped with state-of-the-art instrumentation for the full range of water, waste, air, sediment, and soil quality parameters.

All laboratory work is performed in accordance with guidelines established by USEPA, the Water Pollution Control Federation, and/or the American Society for Testing and Materials (ASTM). When approved protocols do not exist, the ASC staff develops and validates appropriate analytical methods. In addition, QA and QC programs are maintained for the instruments and the analytical procedures used.

E & E's laboratory is certified by the New York State Department of Health for the analysis of drinking water and wastewater, and is approved by the New York State Department of Environmental Conservation for the analysis of samples associated with state-sponsored Superfund activities. In addition, the ASC is contracted to USEPA for the analysis of organic samples under the Contract Laboratory Program (CLP).

Equipment. The ASC is equipped with the most advanced instrumentation for fast, accurate analyses of air, water, and sediment samples. Major instruments include:

- Gas Chromatograph/Mass Spectrometer/Data System (GC/MS/DS), Hewlett Packard Model 5993B, equipped with a disk-based data system and high-speed computer, capillary interface, and jet separator.

- Gas Chromatograph/Mass Spectrometer/Data System (GC/MS/DS), Hewlett Packard Model 5995C, equipped with RTE-6 data system and dual (packed/capillary) column capability.

- Hewlett Packard 5970B Mass Spectral Detector for capillary column operation interfaced to a HP5890 gas chromatograph.

- Hewlett Packard Model 7675A Automated Purge and Trap Sampler.

- Varian Model 3700 Gas Chromatograph (GC) with flame ionization, Hall, and electron capture detectors.

- Varian Vista 6000 GC with electron capture and flame photometric detectors and capillary capability.

- Hewlett Packard 5890 scanning gas chromatograph equipped with electron capture and flame ionization detector.

- Tekmar LSC-2 Liquid Sample Concentrator for volatile organic analysis.

- Varian 4270 Computing Integrator.

- Spectra-Physics Model SP 4100 and SP 4270 Computing Integrators.

- Instrumentation Laboratory Model 457 Fully Automated Atomic Absorption Spectrophotometer including a Model 655 Furnace Atomizer.

- Perkin Elmer 5000 Zeeman Fully Automated Atomic Absorption Spectrophotometer (AAS) with Furnace Atomizer, Zeeman background correction system, and auto sampler.

- Perkin Elmer PE II Inductively Coupled Argon Plasma (ICAP) Spectrometer.

Analytical Capabilities. The ASC is fully equipped for analysis of all types of water, air, and soil samples for chemical contaminants, bacteriological quality, and general characterization. Proven and approved analytical techniques are used, backed up by a rigorous system of QC and QA checks to ensure reliable and defensible data.

Organic analysis is accomplished by GC and/or GC/MS. Liquid, soil, and air samples are analyzed routinely for pesticides, polychlorinated biphenyls, volatile organics, extractable organics, and other groups of compounds as necessary. Facilities for extraction of soil and sludge samples include Soxhlet.

E & E uses two types of instruments for analysis of metals in various matrices: AAS and ICAP. The various AAS techniques include application of flame, furnace, cold vapor, and hydride generation procedures. During sample preparation and analysis, ASC staff are especially careful to avoid the matrix interference effects to which the analysis of solid samples (soil, sediment, and sludge) for trace metals is particularly susceptible. Check standards (either EPA-provided or National Bureau of Standards [NBS]-traceable) are used with each set of prepared samples.

Other instruments in the ASC include a total organic carbon analyzer; specific ion electrodes (fluoride, cyanide, nitrate, ammonia); spectrophotometers; and basic items such as pH and conductivity meters.

Key ASC Personnel

Table 3-1 lists the key individuals from the ASC involved in the QC aspect of the program.

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Table 3-1

KEY ASC PERSONNEL

Name	Position	Education
Andrea P. Schuessler	Corporate QA Officer	B.S. Chemistry
Andrew P. Clifton	Director, Analytical Services Center	B.S. Chemistry
Gary E. Hahn	Manager, Analytical Services Center	B.S. Chemistry
Caryn A. Wojtowicz	Organic Analysis Supervisor	B.A. Biology
Robert E. Bosshart	Inorganic Analysis Supervisor	B.S. Chemistry B.A. Administrative and Management Sciences
Anthony E. Bogolin	Reports Coordinator	B.S. Environmental Science/Biology

4. QA OBJECTIVES FOR MEASUREMENT DATA

All measurements will be made to ensure that analytical results are representative of the media and conditions measured. Unless otherwise specified, all data will be calculated and reported in units consistant with other organizations reporting similar data to allow comparability of data bases among organizations. Data will be reported in ug/l and mg/l for aqueous samples and ug/kg and mg/kg for soils.

The characteristics of major importance for the assessment of generated data are accuracy, precision, completeness, representativeness, and comparability. Accuracy and precision goals for the Dead Creek project are included in the QC tables in Section 8 of this document. The characteristics are defined as follows.

4.1 ACCURACY

Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system. Accuracy determination for this project will be accomplished through a systematic analysis of Standard Reference Materials (SRMs) for calibration and spiking solutions. Obtained values will be compared to "true" values using accepted statistical techniques to provide continuing verification of analytical accuracy.

4.2 PRECISION

Precision is the degree of mutual agreement among individual measurements of a given parameter. Precision determination will be accomplished through regular analysis of duplicate or replicate samples. Relative Percent Difference (RPD) will be calculated for all duplicates and replicates analyzed. EPA has established acceptable RPDs for many of the parameters to be analyzed in this project. These will be compared to obtained RPDs to provide a continuing verification of analytical precision.

4.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.

4.4 REPRESENTATIVENESS

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Careful choice and use of appropriate methods will ensure that samples are representative. This is relatively easy with water or air samples, since these components are homogeneously dispersed. In soil and sediment, contaminants are unlikely to be evenly distributed, and thus it is important for the sampler to exercise good judgment when removing a sample.

4.5 COMPARABILITY

Comparability expresses the confidence with which one data set can be compared to another.

5. SAMPLING PROCEDURES

5.1 AIR INVESTIGATION

The air investigation will include:

- Surveying of sites for "hot spot" off-gassing;
- Identifying and quantifying air releases; and
- Determining background contaminant levels.

The air investigation will include two phases: preliminary source identification and remedial air investigation.

A meteorological station will be set up prior to on-site work to provide baseline data concerning wind direction and speed. The information will be used to determine locations for perimeter monitoring. A baseline volatile organic vapor survey will be conducted on the site prior to any sampling effort to identify areas where potential air problems may exist.

Each site then will be surveyed with an HNu, OVA, or other monitoring equipment. Instrument readings will be recorded for subsequent review and analysis. During this baseline survey, the presence and location of any staining on the ground or exposed waste materials will also be noted and recorded in the field logbooks. An assessment of the vegetative cover on each site will also be made to assist in the planning of additional particulate studies. OVA and HNu values will be recorded for further evaluation.

To achieve the optimum level for the presence of volatile organics in the air, the baseline volatile organic vapor survey should be conducted when ambient air conditions would provide the highest levels. Best results will occur when the air temperature exceeds 80°F and the wind speed is below five miles per hour (mph). Additionally, this baseline survey should be preceded by at least several days of warm weather. Upon completion of this baseline survey, the data will be reviewed with respect to historical information collected regarding waste types and disposal practices.

After all the sites have been surveyed, additional work may be scheduled for those sites demonstrating contaminant air releases. This will entail quantifying and qualifying the exact nature of contaminants being released. High-volume particulate samplers (for detecting metals and low or semi-volatile organic compound contaminants) and Tenax tube collectors (for detecting volatile contaminants) will be set up in at least one upwind and two downwind locations from each area to be investigated. Several additional stations may be distributed to identify base levels of contaminants. High-volume filters and Tenax tubes will be shipped to E & E's Analytical Services Center (ASC) for analysis.

Additional air monitoring data can be inferred from the soil gas monitoring investigation. In this study, volatile substances are traced in the vadose zone. Data from this study can be extrapolated to indicate areas of probable emission of contaminants to the air through natural volatilization.

5.2 SURFACE SOIL SAMPLING

Surface soil samples will be collected according to the procedures described below:

- Samples will be collected to a depth not to exceed 1 foot.
- Using a stainless steel scoop/trough, soil samples will be collected from the ground surface.
- The samples will be transferred to an 8-ounce wide-mouth glass container. As many scoops as necessary will be taken until the sampling bottle is filled.

- The scoop will be decontaminated between samples to avoid cross-contamination.

- Any observable physical characteristics of the soil as it is being sampled (e.g., color, odor, physical state) will be recorded.

- Selected samples will be screened in the field using an OVA. This screening process involves filling a volatile organics bottle 1/2 full with sample material and capping the bottle, then heating the bottle in a pan of water, then uncapping the bottle and inserting the OVA probe into the head space and taking a reading.

- All pertinent weather information such as air temperature, pressure, wind velocity, sky conditions, and precipitation will be recorded.

5.3 SUBSURFACE SOIL SAMPLING

Subsurface sampling will be conducted using a drill rig with a hollow stem auger, minimum diameter 4-1/4 inches. Continuous samples will be collected unless subsurface conditions prevent this. In this case, 0- to 5-foot interval split-spoon samples will be collected. A 4-inch diameter, 5-foot split-spoon sampler with a catcher at the foot is locked into the first auger flight and retrieved with hex rods through the augers. The sampler is advanced by rotating augers to the desired depth.

If field conditions prevent use of this method, a 2-inch diameter, 18-inch split-spoon will be advanced by conventional methods. This will include attachment of the sampler to an AW rod and a standard 140-pound hammer. Blow counts will be recorded at 6-inch intervals to a total sample depth of 18 inches. Borings will be drilled to specified depths mentioned in Section 2.3 unless sample screening dictates stopping at shallower depths.

As samples are retrieved, they will be screened with an OVA and the HNu if deemed necessary. Upon completion of logging the lithology, the sample will be stored in a clean 8-ounce jar. Compositing will be performed at the hotline.

All drilling and sampling equipment to be reused will be decontaminated as specified at the end of this section. When samples are to be composited, mixing will be done using stainless steel containers and tools. These also will be decontaminated between uses. Where possible and appropriate, disposable equipment will be used in order to minimize cross contamination. Prior to the start of the sampling work, all drilling tools and equipment will be washed with high-pressure steam equipment and rinsed with solvent (see Decontamination).

As noted above, selected samples will be field-screened using an OVA and the HNu. A preliminary survey will be also conducted by "sniffing" the sample with an OVA and the HNu immediately upon opening the sampling tube.

Upon completion of the drilling, the open hole will be backfilled with drill cuttings or grouted. Any deficit of material will be supplied using clean earthen material. When the water table is encountered while drilling or the boring goes below the fill, grout will be used to seal that portion of the boring. Grouting will be mixed and pumped from the mud pan through the hollow stem of the auger as the auger is retrieved. The hole will be filled from the top of the grout line to ground level using drill cuttings. Any excess cuttings will be drummed and disposed of in accordance with applicable regulations.

<u>Subsurface Soil Sample Compositing</u>

Compositing of all soil samples will include:

- o Each portion from a depth interval to be composited will be thoroughly mixed in its sample container with a stainless steel tablespoon.

- o The material will be chopped, mixed, and stirred until it is homogeneous.

- o A stainless steel tablespoon will be used to transfer the material to a composite container. A clean stainless steel tablespoon will be dedicated to each depth interval or each

Draft

borehole to be composited. One tablespoon of material from each portion to be composited will be placed into the composite container in succession until the composite container is filled.

- The composite container will then be sealed and labeled as specified in this plan (Section 7.3).

5.4 GROUNDWATER SAMPLING

Sampling of the existing monitoring wells, residential wells, and newly installed monitoring wells will consist of the following three activities:

- Measurement of depth to water level and total depth of the well (to calculate well volume),

- Evacuation of static water (purging), and

- Collection of the sample.

These activities are described below.

5.4.1 Measurement of Water Level and Well Volume

- Prior to sampling, the static water level and total depth of the well will be measured with a calibrated weighted line. Care will be taken to decontaminate equipment between each use to avoid cross contamination of wells.

- The number of linear feet of static water (difference between static water level and total depth of well) will be calculated.

- The static volume will be calculated using the formula:

$$V = Tr^2(0.163)$$

where:

V = Static volume of well in gallons;

T = Depth of water in the well, measured in feet;

r = Inside radius of well casing in inches; and

0.163 = A constant conversion factor which compensates for $\pi r^2 h$ factor for the conversion of the casing radius from inches to feet, the conversion of cubic feet to gallons, and π (pi).

5.4.2 Purging Static Water

Before a groundwater sample is obtained, the static water must be purged to ensure that a representative groundwater sample is taken. A minimum of three static water volumes will be purged from the well prior to collecting the samples. Purging and sampling will be performed using a stainless steel or Teflon bailer. Since the water removed from the well during the purging process could contain hazardous materials, it will be containerized and not discharged on the ground.

5.4.3 Sample Collection

Sampling personnel will take precautions against cross contamination when using one sampling apparatus for a series of samples. If possible, "clean" or "background" samples will be taken first. Before and after each sample is taken, the apparatus will be decontaminated as specified. Sample collection procedures are as follows:

- A stainless steel bailer (decontaminated according to the procedures presented at the end of this section) will be used to collect the groundwater samples.

- Dedicated bailers will be used for monitoring wells. Residential well samples will be collected from existing plumbing as close as possible to the pump and prior to any water softening apparatus.

- When transferring water from the bailer to sample containers, care will be taken to avoid agitating the sample, which promotes the loss of volatile constituents.

- Samples to be analyzed for metals will be filtered in the field and preserved with nitric acid prior to shipment for analysis. Filtering equipment used will be decontaminated between samples to avoid cross contamination. Field filtration requires particular skill if contamination is to be avoided.

- The temperature, pH, and specific conductivity of the water will be measured and recorded at the time of initial purging of the well, during purging, and at the time of sampling, checking for stabilization of parameters. To avoid contamination of samples, field measurements will be performed on a portion of groundwater which is not to be analyzed.

- Any observable physical characteristics of the groundwater (e.g., color, sheen, odor, turbidity,) as it is being sampled, will be recorded.

- Weather conditions at the time of sampling will be recorded (e.g., air temperature, sky condition, recent heavy rainfall, drought conditions), as will any groundwater pumping in the surrounding areas for industrial use which might affect contaminant migration.

5.5 SURFACE WATER/SEDIMENT SAMPLING

5.5.1 Surface Water Sampling

Surface water samples will be collected according to the following procedures:

- A wide-mouth glass bottle to be used for sampling will be dipped into the creek and rinsed three times and the bottle will then be dipped to collect the sample.

- The sample will be collected in such a manner as to prevent agitation of the water, which promotes the loss of volatile organics and increases the dissolved oxygen content.

- The samples will be transferred into 1/2-gallon glass bottles and 40-ml VOA bottles. The wide-mouth bottle will be refilled as many times as necessary to fill all required bottles.

- Prior to filling 800-ml plastic bottles to be used for inorganic samples, the water will be filtered. Nitric acid will be introduced into the plastic bottles to preserve the metals. Filtering equipment used will be decontaminated between samples to avoid cross contamination. Field filtration requires particular skill if contamination is to be avoided.

- The temperature, pH, and specific conductivity of the water will be measured, and current speed/volume will be recorded at the time the sample is taken.

- Any observable physical characteristics of the water (e.g., color, odor, turbidity) as it is being sampled will be recorded.

- Weather conditions at the time of sampling will be recorded, including air temperature, barometric pressure, sky conditions, recent heavy rainfalls, and wind velocity.

5.5.2 Sediment Sampling

Sediment samples will be collected from Dead Creek using a Peterson dredge or stainless steel trowels. The sampling procedure will be as follows:

- The Peterson dredge will be decontaminated as specified in Section 9.

- The dredge will be lowered into the creek sediment until sufficient resistance is encountered to release the retainer catch. The dredge will then be withdrawn from the sediments.

- o The contents of the dredge will be placed in a clean stainless steel pan and composited. A composite sample of the sediment will be transferred to an 8-ounce jar.

5.6 SOIL GAS SURVEY

Soil gas analyses will be performed along a grid of 100-foot intervals covering a pre-surveyed area. Results will be compiled and plotted on a site base map. Areas with high readings will be resurveyed at 50-foot intervals. One sample will be taken outside the area of contamination to establish background levels.

Experience with soil gas monitoring has shown that the most conducive weather conditions for a successful survey are during warm, dry, low-wind conditions following several days of warm to hot weather. The survey will be planned for such conditions.

The survey will consist of three soil gas samples taken at 4, 7, and 10 feet below the surface at each sampling location. Although sample locations have generally been identified, the exact locations will be determined in the field based upon an assessment of field conditions, surface evidence of past dumping practices and contamination, and topographic relief.

The soil gas survey will be conducted using either a slam bar/OVA technique or a perforated tube/bag method. The slam bar technique uses a steel rod that is driven into the soil with a weight that slides along the top of the rod. The slam bar will be driven into the soil to a depth of 3 feet or to maximum penetration. When the slam bar is withdrawn, the air in the resultant hole will be analyzed with an OVA for volatile organic compounds.

The primary equipment to be used for the soil gas survey consists of the following:

1. A miniature well point sampler, 5/8-inch in diameter, stainless steel, with 3/8-inch hollow center. The shaft is tipped with a sharp penetrating point and has a narrow, vertically slotted screen. The internal-thread 2.5-foot sections are driven into the soil using a special cylindrical hammer. Connectors allow hook-up to various types of sample analysis equipment.

2. An OVA for determining the total concentration of organic vapors using a flame ionization detector.

The following procedures will be followed at each of the sampling locations.

1. A decontaminated well point sampler will initially be driven into the soil to a depth of 4 feet at each location.

2. Sample tube fittings will be attached to the samples and one volume of air purged from the system using a syringe or piston displacement device.

3. A sample collection bag will be attached to the system and the bag will be filled using a syringe or piston displacement device. The sample bag will then be carried to a van for analysis.

4. The OVA will be set up and operated in the van to standardize analytical conditions. Bag samples will be allowed to equilibrate with internal van conditions. Once equilibrium has been reached, the bag sample will be connected to the OVA (operated in survey mode) and analyzed for total volatile organic substances. An activated carbon filter will be used to check for the presence of methane. Prior to each set of analyses, the OVA will be "zeroed" in a background area and ambient background readings will be recorded. Temperature readings will be recorded during the background measurement and during the sampling.

5. Depending on field conditions, it may be necessary to substitute a slightly different sample collection and analysis procedure. Should weather and soil conditions preclude the use of the analysis equipment described, the equipment and/or techniques will be modified accordingly. All modifications will be documented and appropriate controls instituted for maintaining sample integrity. In any case, the equivalent of

one air volume for each sample and depth will be purged prior to collecting the sample for analysis. If no contaminants are detected in a sample, the sample bags may be reused.

6. Upon completion of sampling at 4 feet, the well point will be blown clear with compressed air (D or E quality) and the well point will be driven to the next sampling interval (samples will be collected at 4, 7, and 10 feet). Procedures 1 to 5 will be repeated at each interval.

7. Upon completion of sampling at each location, the well point will be withdrawn from the ground and the hole backfilled by injecting a bentonite slurry into it.

8. The well point will be decontaminated as specified in Section 9. The sample analytical equipment tubing will be purged until a stable "zero" or background reading is obtained.

9. All data well point locations and sample results will be recorded in a log book of field activities. Data will be tabulated and plotted on a site base map and used for assessment and planning of future investigative work.

10. A duplicate analysis will be collected after every 20 analyses.

The OVA will be calibrated in accordance with the manufacturer's specifications twice daily, once prior to commencing operations and once after 4 hours of field sampling.

5.7 DECONTAMINATION

Sampling methods and equipment have been chosen to minimize decontamination requirements and the possibility of cross contamination. Any sample tubing, rope, rods, etc., will be disposed of after sampling. Sampling equipment used on more than one location will be decontaminated between locations by following these steps:

- Steam clean (drilling equipment only);
- Scrub with brushes in trisodium phosphate (TSP) solution;
- Rinse with deionized water;
- Rinse with acetone;
- Rinse with hexane;
- Rinse with acetone; and
- Rinse with deionized water.

6. SAMPLE CUSTODY

6.1 STANDARD OPERATING PROCEDURES

This section describes standard operating procedures for sample identification and chain-of-custody. The purpose of these procedures is to ensure that the quality of the samples is maintained during their collection, transportation, and storage through analysis. All chain-of-custody requirements comply with standard operating procedures indicated in USEPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the E & E ASC are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, August 1985.

Sample identification documents must be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include:

- Field notebooks;
- Sample label;
- Custody seals; and
- Chain-of-custody records.

6.1.1 Chain-of-Custody

The primary objective of the chain-of-custody procedures is to provide an accurate written record that can be used to trace the possession and handling of a sample from the moment of its collection through its analyses. A sample is in custody if it is:

- In someone's physical possession;
- In someone's view;
- Locked up; or
- Kept in a secured area that is restricted to authorized personnel.

Field Custody Procedures

- As few persons as possible should handle samples.
- The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly.
- The sample collector will record sample data in the field notebook.
- The site team leader will determine whether proper custody procedures were followed during the fieldwork and decide if additional samples are required.

Sample Tags

Sample tags attached to or affixed around the sample container must be used to properly identify all samples taken in the field. The sample tags are to be placed on the bottles so as not to obscure any QA/QC data on the bottles; sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross-reference with the logbook. For chain-of-custody purposes, all QC samples are subject to exactly the same custodial procedures and documentation as "real" samples.

Chain-of-Custody Record

The chain-of-custody record must be fully completed in duplicate, using black carbon paper where possible, by the field technician who has been designated by the project manager as responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g., extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the "Remarks" section of the custody record.

Transfer of Custody and Shipment

- Samples must be accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving them must sign, date, and note the time on the record. This record documents sample custody transfer.

- Samples must be dispatched to the ASC for analysis with a separate chain-of-custody record accompanying each shipment. Shipping containers must be sealed with custody seals for shipment to the laboratory. The method of shipment, name of courier, and other pertinent information are entered in the "Remarks" section of the chain-of-custody record.

- All shipments must be accompanied by the chain-of-custody record identifying their contents. The original record accompanies the shipment, and the yellow copy is retained by the site team leader.

- If sent by mail, the package is registered with return receipt requested. If sent by common carrier, a bill of lading is used. Freight bills, Postal Service receipts, and bills of lading are retained as part of the permanent documentation.

Laboratory Custody Procedures. A designated sample custodian accepts custody of the shipped samples and verifies that the sample identification number matches that on the chain-of-custody record. Pertinent information as to shipment, pickup, and courier is entered in the "Remarks" section. The custodian then enters sample identification number data into a bound logbook, which is arranged by a project code and station number.

Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. A custody seal is placed over the cap of individual sample bottles by the sampling technician. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) are sealed in as many places as necessary to ensure security. Seals must be signed and dated before use. On receipt at the laboratory, the custodian must check (and certify, by completing logbook entries) that seals on boxes and bottles are intact. Clear tape should be placed over the seals to ensure that seals are not accidentally broken during shipment.

6.1.2 Documentation

Sample Identification

All containers of samples collected from the Dead Creek project will be identified using the following format on a label or tag fixed to the sample container (labels are to be covered with Mylar tape):

DC-XX-O

- DC - This set of initials indicates the sample is from the Dead Creek project.
- XX - These characters identify the sample location. Actual sample locations will be recorded in the task log.
- O/D - This character will be either "O" for original sample, or "D" for duplicate.

Each sample will be labeled and sealed immediately after collection. To minimize handling of sample containers, labels will be filled out prior to sample collection. The sample label will be filled out using waterproof ink and will be firmly affixed to the sample containers and protected with Mylar tape. The sample label will give the following information:

- Date,
- Sample number,
- Sample volume,
- Analysis required,
- pH, and
- Preservation.

Daily Logs

Daily logs and data forms are necessary to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. All daily logs will be kept in a bound waterproof notebook containing numbered pages. All entries will be made in waterproof ink, dated, and signed. No pages will be removed for any reason. Corrections will be made according to the procedures given at the end of this section. The daily logs will include a site log and a task log.

The Site Log is the responsibility of the site team leader and will include a complete summary of the day's activity at the site.

The Task Log will include:

- Name of person making entry (signature).
- Names of team members on-site.
- Levels of personnel protection:
  - Level of protection originally used,
  - Changes in protection, if required, and
  - Reasons for changes.
- Time spent collecting samples.
- Weather conditions.
- Documentation on samples taken, including:
  - Sampling location and depth station numbers;
  - Sampling date and time, sampling personnel; and

  - Type of sample (grab, composite, etc.), matrix.
- On-site measurement data.
- Field observations and remarks.
- Weather conditions, wind direction, etc.
- Unusual circumstances or difficulties.
- Initials of person recording the information.

Corrections to Documentation

Notebook

As with any data logbooks, no pages will be removed for any reason. If corrections are necessary, these must be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction must be initialed and dated. Most corrected errors will require a footnote explaining the correction.

Sampling Forms

As previously stated, all sample identification tags, chain-of-custody records, and other forms must be written in waterproof ink. None of these documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on a document assigned to one individual, that individual may make corrections simply by crossing a line through the error and entering the corrected information. The incorrect information should not be obliterated. Any subsequent error discovered on a document should be corrected by the person who made the entry. All corrections must be initialed and dated.

Photographs

Photographs will be taken as directed by the team leader. Documentation of a photograph is crucial to its validity as a representation of an existing situation. The following information will be noted in the task log concerning photographs:

- Date, time, location photograph was taken,

- Photographer (signature),

- Weather conditions,

- Description of photograph taken,

- Reasons why photograph was taken,

- Sequential number of the photograph and the film roll number, and

- Camera lens system used.

After the photographs have been developed, the information recorded in the field notebook should be transferred to the back of the photographs.

6.1.3 Sample Handling, Packaging, and Shipping

The transportation and handling of samples must be accomplished in a manner that not only protects the integrity of the sample but also prevents any detrimental effects due to the possible hazardous nature of samples. Regulations for packaging, marking, labeling, and shipping hazardous materials are promulgated by the United States Department of Transportation (DOT) in the Code of Federal Regulations, 49 CFR 171 through 177.

All chain-of-custody requirements must comply with standard operating procedures in the USEPA sample handling protocol. All sample control and chain-of-custody procedures applicable to the E & E Analytical Services Center (ASC) are presented in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/ Quality Control Procedures Manual, dated August 1985.

Sample Packaging

Samples must be packaged carefully to avoid breakage or contamination and must be shipped to the laboratory at proper temperatures. The following sample packaging requirements will be followed:

- Sample bottle lids must never be mixed. All sample lids must stay with the original containers. Custody seals must be affixed.

- The sample volume level can be marked by placing the top of the label at the appropriate sample height, or with a grease pencil. This procedure will help the laboratory to determine if any leakage occurred during shipment. The label should not cover any bottle preparation QA/QC marks.

- All sample bottles must be secured with a custody seal and placed in a plastic bag to minimize the potential for vermiculite contamination.

- Shipping coolers must be partially filled with packing materials to prevent the bottles from moving during shipment.

- The secured sample bottles must be placed in the cooler in such a way as to ensure that they do not touch one another.

- The environmental samples are to be cooled. The use of "blue ice" or some other artificial icing material is preferred. If necessary, ice may be used, provided that it is placed in plastic bags. Ice is not to be used as a substitute for packing materials.

- Any remaining space in the cooler should be filled with inert packing material. Under no circumstances should material such as sawdust, sand, etc., be used.

- A duplicate custody record must be placed in a plastic bag and taped to the bottom of the cooler lid.

Note: The ASC does not knowingly accept samples with high levels of radioactivity or dioxins, or any samples for which ASC handling procedures may be insufficient to protect laboratory employees. Project staff and field staff must take all feasible precautions, including discussions with site officials and company representatives, and site observations to ensure that neither they nor ASC personnel are exposed to unduly hazardous materials. Note that field staff are (in many cases) equipped with personal protection and breathing apparatus not available to ASC personnel.

Shipping Containers

Environmental samples will be properly packaged and labeled for transport and dispatched for analysis to the Ecology and Environment, Inc., Analytical Services Center located at 4285 Genesee Street, Buffalo, New York, 14225. A separate chain-of-custody record must be prepared for each container. The following requirements for shipping containers will be followed.

Shipping containers are to be custody-sealed for shipment as appropriate. The container custody seal will consist of filament tape wrapped around the package at least twice and custody seals affixed in such a way that access to the container can be gained only by cutting the filament tape and breaking a seal.

Field personnel will make arrangements for transportation of samples to the ASC. When custody is relinquished to a shipper, field personnel will telephone the ASC custodian (716/631-0360) to inform him of the expected time of arrival of the sample shipment and to advise him of any time constraints on sample analysis. The ASC must be notified as early in the week as possible, and in no case later than 3 p.m. (eastern time zone) on Thursday, regarding samples intended for Saturday delivery. Samples will be retained by the ASC for 30 days after the final report is submitted.

Marking and Labeling

- Use abbreviations only where specified.

The words "This End Up" or "This Side Up" must be clearly printed on the top of the outer package. Upward pointing arrows should be placed on the sides of the package. The words "Laboratory Samples" should also be printed on the top of the package.

- After a container has been sealed, two chain-of-custody seals are placed on the container, one on the front and one on the back. The seals are protected from accidental damage by placing Mylar tape over them.

7. CALIBRATION PROCEDURES AND FREQUENCY

All instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set forth in the analytical methodology of the Contract Laboratory Program for organic and inorganic analyses. Operation, calibration, and maintenance will be performed by personnel properly trained in these procedures. Documentation of all routine and special maintenance and calibration information will be maintained in an appropriate logbook or reference file and will be available on request. Table 7-1 lists the major instruments to be used for sampling and analysis.

Laboratory capabilities will be initially demonstrated for instrument and reagent/standards performance as well as accuracy and precision of analytical methodology. Daily GC/MS performance tests will be implemented as required and are referenced in the methods to be used.

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Table 7-1

LIST OF MAJOR INSTRUMENTS TO BE USED IN THE DEAD CREEK SAMPLING AND ANALYSIS PROGRAM*

- MSA 260 O_2 Explosimeter
- HNu PI-101 Photoionization Analyzer
- Organic Vapor Analyzer Foxboro (128)
- Temperature/Conductivity Meter - Portable
- Hewlett Packard (HP) 1000 computer with RTE-6 operating system; equipped with Aquarius software for control and data acquisition from up to four gas chromatograph/mass spectrometer (GC/MS) systems; combined Wiley and National Bureau of Standards (NBS) mass spectral library; and data archiving on magnetic tape.
- HP5993 GC/MS equipped with packed columns for analysis of volatile organic compounds.
- HP5995C GC/MS equipped with both packed and capillary columns for analysis of all priority pollutant organic compounds.
- HP5970 Mass Spectral Detector interfaced with an HP5890 GC for capillary column determination of semi-volatile priority pollutant compounds.
- Tekmar LSC-2 Liquid Sample Concentrator for volatile organic analysis.
- Hewlett Packard Model 7675A Automated Purge and Trap Sampler.
- Varian 6000 and 3700 Gas Chromatrographs (total 3) equipped with flame ionization, electron capture, photoionization and Hall detectors as appropriate for various analyses
- Spectra-Physics Model SP 4100 and SP 4270 Computing Integrators.
- Instrumentation Laboratory Model 457 Fully Automated Atomic Absorption Spectrophotometer, including a Model 655 Furnace Atomizer.
- Perkin Elmer 5000Z Fully Automated Atomic Absorption Spectrophotometer (AAS) with Furnace Atomizer and Zeeman background correction system.
- Perkin Elmer PE II Inductively Coupled Argon Plasma (ICAP) Spectrometer.

*Calibrated, maintained, and operated according to manufacturer's specifications and all QC protocols within the appropriate methodology. Both lamps (10.2 eV, 11.7 eV) will be used with the HNu Photoionizer. Isobutylene will be used as the calibration gas. The HNu, the OVA, and the MSA 260 O_2 Explosimeter will be calibrated, at a minimum, before use each day, or as required if field problems arise.

8. ANALYTICAL PROCEDURES

Analytical methods to be utilized for the sampling tasks are referenced in USEPA documents: Contract Laboratory Program - Organic Analysis, Statement of Work (SOW), Multimedia, Multiconcentration, Revised July 1985 and Inorganic Analysis, SOW No. 784, July 1984. Included in Tables 8-1, 8-2, and 8-3 are detection limits for the GC/MS and GC organic analysis and inorganic (metals) analysis. Tables 8-4 through 8-8 include QC guidelines for the inorganic and organic analyses. Information on sample containers, preservation, and holding times are given in Table 8-9.

Methodology references contain specific QC criteria associated with the particular methods. These specific requirements include calibration, tuning, and QC samples and are described in detail within the methods. Daily performance tests and demonstration of precision and accuracy are required.

In addition, all analytical staff members will follow E & E protocol as set forth in E & E's Laboratory and Field Personnel Chain-of-Custody Documentation and Quality Assurance/Quality Control Procedures Manual, August 1985.

Table 8-1*

DEAD CREEK ORGANIC ANALYSIS HAZARDOUS SUBSTANCE LIST (HSL)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/Sediment (ug/kg)
Volatiles			
Chloromethane	74-87-3	10	10
Bromomethane	74-83-9	10	10
Vinyl chloride	75-01-4	10	10
Chlorethane	75-00-3	10	10
Methylene chloride	75-09-2	5	5
Acetone	67-64-1	5	10
Carbon disulfide	75-15-0	5	5
1,1-dichloroethene	75-35-4	5	5
1,1-dichloroethane	75-35-3	5	5
trans-1,2-dichloroethene	156-60-5	5	5
Chloroform	67-66-3	5	5
1,2-dichloroethane	107-06-2	5	5
2-butanone	78-93-3	10	10
1,1,1-trichloroethane	71-55-6	5	5
Carbon tetrachloride	56-23-5	5	5
Vinyl acetate	108-05-4	10	10
Bromodichloromethane	75-27-4	5	5
1,1,2,2-tetrachloroethane	79-34-5	5	5
1,2-dichloropropane	78-87-5	5	5
trans-1,2-dichloropropene	10061-02-6	5	5
Trichloroethene	79-01-6	5	5
Dibromochloromethane	124-48-1	5	5
1,1,2-trichloroethane	79-00-5	5	5
Benzene	71-43-2	5	5
cis-2,3-dichloropropene	10061-01-5	5	5
2-chloroethyl vinyl ether	110-75-8	10	10
Bromoform	75-25-2	5	5
2-hexanone	591-78-6	10	10
4-methyl-2-pentanone	108-10-1	10	10
Tetrachloroethene	127-18-4	5	5
Toluene	108-88-3	5	5
Chlorobenzene	108-90-7	5	5
Ethyl benzene	100-41-4	5	5
Styrene	100-42-5	5	5
Total xylenes		5	5

*Referenced - USEPA Contract Laboratory Program, revised July 1985.

Note:

Medium Water Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Water CRDL.

Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Volatile HSL Compounds are 100 times the individual Low Soil/Sediment CRDL.

Table 8-1 (Cont.)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/Sediment (ug/kg)
Semi-Volatiles			
Phenol	108-95-2	10	330
bis(2-chloroethyl) ether	111-44-4	10	330
2-chlorophenol	95-57-8	10	330
1,3-dichlorobenzene	541-73-1	10	330
1,4-dichlorobenzene	106-46-7	10	330
Benzyl alcohol	100-51-6	10	330
1,2-dichlorobenzene	95-50-1	10	330
2-methylphenol	95-48-7	10	330
bis(2-chloroisopropyl) ether	39638-32-9	10	330
4-methylphenol	106-44-5	10	330
N-nitroso-Dipropylamine	621-64-7	10	330
Hexachloroethane	67-72-1	10	330
Nitrobenzene	98-95-3	10	330
Isophorone	78-59-1	10	330
2-nitrophenol	88-75-5	10	330
2,4-dimethylphenol	105-67-9	10	330
Benzoic acid	65-85-0	50	1,600
bis(2-chloroethoxy) methane	111-91-1	10	330
2,4-dichlorophenol	120-83-2	10	330
1,2,4-trichlorobenzene	120-82-1	10	330
Naphthalene	91-20-3	10	330
4-chloroaniline	106-47-8	10	330
Hexachlorobutadiene	87-68-3	10	330
4-chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
2-methylnaphthalene	91-57-6	10	330
Hexachlorocyclopentadiene	77-47-4	10	330
2,4,6-trichlorophenol	88-06-2	10	330
2,4,5-trichlorophenol	95-95-4	50	1,600
2-chloronaphthalene	91-58-7	10	330
2-nitroaniline	88-74-4	50	1,600
Dimethyl phthalate	131-11-3	10	330
Acenaphthylene	208-96-8	10	330
3-nitroaniline	99-09-2	50	1,600

Table 8-1 (Cont.)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/Sediment (ug/kg)
Semi-Volatiles			
Acenaphthene	83-32-9	10	330
2,4-dinitrophenol	51-28-5	50	1,600
4-nitrophenol	100-02-7	50	1,600
Dibenzofuran	132-64-9	10	330
2,4-dinitrotoluene	121-14-2	10	330
2,6-dinitrotoluene	606-20-2	10	330
Diethylphthalate	84-66-2	10	330
4-chlorophenyl phenyl ether	7005-72-3	10	330
Fluorene	86-73-7	10	330
4-nitroaniline	100-01-6	50	1,600
4,6-dinitro-2-methylphenol	534-52-1	50	1,600
N-nitrosodiphenylamine	86-30-6	10	330
4-bromophenyl phenyl ether	101-55-3	10	330
Hexachlorobenzene	118-74-1	10	330
Pentachlorophenol	87-86-5	50	1,600
Phenanthrene	85-01-8	10	330
Anthracene	120-12-7	10	330
Di-n-butylphthalate	84-74-2	10	330
Fluoranthene	206-44-0	10	330
Pyrene	129-00-0	10	330
Butyl benzyl phthalate	85-68-7	10	330
3,3'-dichlorobenzidine	91-94-1	20	660
Benzo(a)anthracene	56-55-3	10	330
bis(2-ethylhexyl)phthalate	117-81-7	10	330
Chrysene	218-01-9	10	330
Di-n-octyl phthalate	117-84-0	10	330
Benzo(b)fluoranthene	205-99-2	10	330
Benzo(k)fluoranthene	207-08-9	10	330
Benzo(a)pyrene	50-32-8	10	330
Indeno(1,2,3-cd)pyrene	193-39-5	10	330
Dibenz(a,h)anthracene	53-70-3	10	330
Benzo(g,h,i)perylene	191-24-2	10	330

Note:

Medium Water Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 100 times the individual Low Water CRDL.

Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Semi-Volatile HSL Compounds are 60 times the individual Low Soil/Sediment CRDL.

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Table 8-1 (Cont.)

Compound	CAS Number	Detection Limits: Low Water (ug/L)	Detection Limits: Low Soil/Sediment (ug/kg)
Pesticides and Polychlorinated Biphenyls (PCBs)			
alpha-BHC	319-84-6	0.05	8
beta-BHC	319-85-7	0.05	8
delta-BHC	319-86-8	0.05	8
gamma-BHC (lindane)	58-89-9	0.05	8
Heptachlor	76-44-8	0.05	8
Aldrin	309-00-2	0.05	8
Heptachlor Epoxide	1024-57-3	0.05	8
Endosulfan I	959-98-8	0.05	8
Dieldrin	60-57-1	0.10	16
4,4'-DDE	72-55-9	0.10	16
Endosulfan II	33213-65-9	0.10	16
4,4'-DDD	72-54-8	0.10	16
Endosulfan Sulfate	1031-07-8	0.10	16
4,4'-DDT	50-29-3	0.10	16
Endrin Ketone	53494-70-5	0.10	16
Methoxychlor	72-43-5	0.5	80
Chlordane	57-74-9	0.5	80
Toxaphene	8001-35-2	1.0	160
Aroclor-1016	12674-11-2	0.5	80
Aroclor-1221	11104-28-2	0.5	80
Aroclor-1232	11141-16-5	0.5	80
Aroclor-1242	53469-21-9	0.5	80
Aroclor-1248	12672-29-6	0.5	80
Aroclor-1254	11097-69-1	1.0	160
Aroclor-1260	11096-82-5	1.0	160

Notes:

Medium Water Contract Required Detection Limits (CRDL) for Pesticide/PCB HSL Compounds are 100 times the individual Low Water CRDL.

Medium Soil/Sediment Contract Required Detection Limits (CRDL) for Pesticide/PCB HSL compounds are 15 times the individual Low Soil/Sediment CRDL.

Detection limits listed for soil/sediment are based on wet weight. The detection limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, as required by the contract, will be higher.

Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

Table 8-2*

ELEMENTS DETERMINED BY INDUCTIVELY COUPLED PLASMA EMISSION OR ATOMIC ABSORPTION SPECTROSCOPY

Element	Contract Required Detection Level (ug/L)
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5,000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Magnesium	5,000
Manganese	15
Mercury	0.2
Nickel	40
Potassium	5,000
Selenium	5
Silver	10
Sodium	5,000
Thallium	10
Tin	40
Vanadium	50
Zinc	20

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-3*

CYANIDE DETERMINATION

Element	Contract Required Detection Level (ug/L)
Cyanide	10

*Referenced - USEPA Contract Laboratory Program, July 1984.

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Table 8-4*

INITIAL AND CONTINUING CALIBRATION VERIFICATION
CONTROL LIMITS FOR INORGANIC ANALYSES

Analytical Method	Inorganic Species	% of True Value (EPA Set) Low Limit	High Limit
ICP Spectroscopy/ Flame Atomic Absorption Spectrometry	Metals	90	110
Furnace AA	Metals	90	110
	Tin	80	120
Cold Vapor AA	Mercury	80	120
Other	Cyanide	90	110

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-5*

INTERFERENT AND ANALYTE ELEMENTAL CONCENTRATIONS
USED FOR ICP INTERFERENCE CHECK SAMPLE

Analytes	(mg/L)	Interferents	(mg/L)
Silver	0.5	Aluminum	500
Arsenic	1.0	Calcium	500
Barium	0.5	Iron	500
Beryllium	0.5	Magnesium	500
Cadmium	1.0		
Cobalt	0.5		
Chromium	0.5		
Copper	0.5		
Manganese	0.5		
Nickel	1.0		
Lead	1.0		
Antimony	1.0		
Selenium	1.0		
Thallium	1.0		
Vanadium	0.5		
Zinc	1.0		

*Referenced - USEPA Contract Laboratory Program, July 1984.

Table 8-6

INTERFERENT AND ANALYTE ELEMENTAL CONCENTRATIONS
USED FOR INTERFERENCE MEASUREMENTS IN TABLE 8-5*

Analytes	(mg/L)	Interferents	(mg/L)
Aluminum	10	Aluminum	1,000
Arsenic	10	Calcium	1,000
Boron	10	Chromium	200
Barium	1	Copper	200
Beryllium	1	Iron	1,000
Calcium	1	Magnesium	1,000
Cadmium	10	Manganese	200
Cobalt	1	Nickel	200
Chromium	1	Titanium	200
Copper	1	Vanadium	200
Iron	1		
Magnesium	1		
Manganese	1		
Molybdenum	10		
Sodium	10		
Nickel	10		
Lead	10		
Antimony	10		
Selenium	10		
Silicon	1		
Thallium	10		
Vanadium	1		
Zinc	10		

Note: 100 ± 20% recovery required for ICP interference check.

*Referenced - USEPA Contract Laboratory Program, Revised July 1984.

Table 8-7

CONTRACT REQUIRED SURROGATE SPIKE RECOVERY LIMITS*

Fraction	Surrogate Compound	Low/Medium Water	Low/Medium Soil/Sediment
VOA	Toluene-d_8	88 - 110	81 - 117
VOA	4-bromofluorobenzene	86 - 115	74 - 121
VOA	1,2-dichloroethane-d_4	76 - 114	70 - 121
BNA	Nitrobenzene-d_5	35 - 114	23 - 120
BNA	2-fluorobiphenyl	43 - 116	30 - 115
BNA	p-terphenyl-d_{14}	33 - 141	18 - 137
BNA	Phenol-d_5	10 - 94	24 - 113
BNA	2-fluorophenol	21 - 100	25 - 121
BNA	2,4,6-tribromophenol	10 - 123	19 - 122
Pest	Dibutylchlorendate	(24 - 154)**	(20 - 150)**

*Referenced - USEPA Contract Laboratory Program, revised July 1985.

**These limits are for advisory purposes only. They are not used to determine if a sample should be reanalyzed. When sufficient data becomes available, the USEPA may set performance based contract required windows.

Table 8-9

SAMPLE CONTAINERS, VOLUMES, PRESERVATION, AND HOLDING TIMES

Type of Analysis	Type and Size of Container	Number of Containers and Sample Volume (per Sample)	Preservation	Maximum Holding Time
Purgeable (Volatile) Organics	40-ml glass vial, with Teflon-backed septum	Two (2); fill completely, no air space	Cool to 4°C (ice in cooler)	7 days
Extractable Organics, PCBs, Pesticides	1/2-gallon bottles with Teflon-lined caps	Two (2); total volume approx. 1 gallon; fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days
Metals	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill completely	Nitric acid to below pH 2 (approx. 1.5 ml Con HNO_3 per liter)	6 months
Cyanides	1-liter polyethylene bottle with polyethylene-lined caps	One (1); fill completely	Sodium hydroxide to pH 12 and cool to 4°C (ice in cooler)	24 hours, if sulfide present; 14 days
2,3,7,8 TCDD	8-oz-glass jar with Teflon-lined cap	One (1); fill completely	Cool to 4°C (ice in cooler)	Must be extracted within 5 days; analyzed within 30 days

Note: Soil samples for metals analysis will be delivered in an 8-oz. jar with Teflon-lined cap half-filled. The laboratory staff can then homogenize the sample by mixing it in the original sample container. Soil samples for extractables and cyanide will be delivered in 8 oz. glass jars with Teflon-lined caps filled completely.

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9. DATA REDUCTION, VALIDATION, AND REPORTING

QA/QC requirements from both methodology and company protocols will be strictly adhered to during sampling and analytical work. All data generated will be reviewed by comparing and interpreting results from chromatograms (responses, stability of retention times), accuracy (mean percent recovery of spiked samples), and precision (reproducibility of results). Refer to Section 10 for detailed discussion of QA/QC protocol.

All calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results.

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. Analytical and field QC will be documented and included in the report. The central file will be maintained for the sampling and analytical effort for a period of five years after the final report is issued.

Reports will be reviewed by the laboratory supervisor, the QA officer, ASC manager and/or director, and the project manager. The following information will be included in the analytical reports:

1. Scope and Application

   - Type of analyses, parameters of interest, Method Detection Limits (MDLs), acceptance criteria for precision, accuracy, and completeness

2. Analytical Methods (referenced)

3. Method Blank Analysis

   - Types of impurities and contamination

4. Quality Control

   - Demonstration of competence by meeting limits for acceptance criteria for precision, accuracy, and completeness

   - Records kept and reported with sample results

5. Criteria for Quantitative Identification

   - Results reported in ug/l, ug/kg or mg/l, mg/kg

6. Method Verification

   - Demonstration of precision and accuracy

7. Calibration

   - Internal/external standards used

8. Daily Performance Tests for Instrumentation

   - Tuning and calibration

9. Criteria for Qualitative Identification

   - Criteria for positive identification

   - Chromatograms

The following information will not be included in the analytical reports but are available within the Sampling Plan, QAPP, and Health and Safety documents for the Dead Creek Project.

10. Safety

    - Detailed summary of safety protocols followed

11. Apparatus and Materials

    - Sampling equipment, instruments used for analysis

12. Reagents

    - Types of reagents used, preparation of standard solutions

13. Sampling

    - Techniques used

14. Sample Preservation and Handling

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DATA GENERATED BY ANALYSTS

↓

DOCUMENTED IN LOGBOOKS/DATA SHEETS OR ON MAGNETIC TAPE

↓

DATA APPROVED BY RESPECTIVE LAB SUPERVISOR

↓

DATA TABULATED AND COMPILED INTO REPORT FORMAT
(Job File)

↓

REPORT APPROVED BY RESPECTIVE SUPERVISOR

↓

REPORT APPROVED BY QA OFFICER

↓

REPORT APPROVED BY LABORATORY MANAGER

↓

REPORT APPROVED BY PROJECT MANAGER

↓

REPORT SUBMITTED TO CLIENT

Figure 9–1 DATA FLOW/REPORTING SCHEME

10. INTERNAL QUALITY CONTROL CHECKS

QC data is necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. Laboratory-based QC will comprise at least 10% of each data set generated and will consist of standards, replicates, spikes, and blanks. Depending upon the particular method used, QC may be more rigorous, but at a minimum, one spike or replicate per 10 samples and one method blank per 20 samples or run, whichever is greater, will be utilized for every analytical run. Field duplicates and field blanks will be analyzed by the laboratory as samples and will not necessarily be identified to the laboratory as duplicates or blanks. Split samples in the field will be provided to IEPA upon request to be analyzed independently. Calculations will be performed for recoveries and standard deviations along with review of retention times, response factors, chromatograms, calibration, tuning, and all other QC information generated. All QC data, including split samples, will be documented in the site logbook. QC records will be retained and results reported with sample data. Specific QC requirements for the organic and inorganic analyses are incorporated in USEPA's Contract Laboratory Program, Scope of Work for Organic and Inorganic Analyses.

Blank Samples

Blank samples are analyzed in order to assess possible contamination from the field and/or laboratory so that corrective measures may be taken, if necessary. Blank samples include:

- Field Blanks - These blank samples are exposed to field and sampling conditions and analyzed in order to assess possible contamination from the field.

- Method Blanks - These blank samples are prepared in the laboratory and are analyzed in order to assess possible laboratory contamination.

- Reagent and Solvent Blanks - These blank samples are prepared in the laboratory and analyzed in order to determine the background of each of the reagents or solvents used in an analysis.

Analytical Replicates

Replicate samples are aliquots of a single sample that is split on arrival at the laboratory or upon analysis. Replicates may be made if no duplicates are provided by the field sampling team; however, their purposes are not always interchangeable. Significant differences between two replicates that are split in a controlled laboratory environment usually are due to poor analytical technique.

Calibration Standards

A calibration standard is prepared in the laboratory by dissolving a known amount of a pure compound in an appropriate matrix. The final concentration calculated from the known quantities is the true value of the standard. The results obtained from these standards are used to generate a standard curve and thereby quantitate the compound in the environmental sample. A minimum of three calibration standards will be used to generate a standard curve for all analyses.

Check Standard

A check standard is prepared in the same manner as a calibration standard or may be obtained from USEPA. The final concentration calculated from the known quantities is the "true" value of the standard. The important difference in a check standard is that it is not carried through the same process used for the environmental samples, but is analyzed without digestion or extraction. A check standard result is used to validate an existing concentration calibration standard file or calibration curve. The check standard can provide information on the accuracy of the instrumental analytical method independent of various sample matrices.

Spike Sample

A sample spike is prepared by adding to an environmental sample (before extraction or digestion), a known amount of pure compound of the same type that is to be assayed for in the environmental sample. These spikes simulate the background and interferences found in the actual samples and the calculated percent recovery of the spike is taken as a measure of the accuracy of the total analytical method. When there is no change in volume due to the spike, it is calculated as follows:

$$\% R = \frac{100\ (0-X)}{T}$$

where, % R = Percent recovery;

0 = Measured value of analyte; and

X = Measured value of analyte concentration in the sample before the spike is added.

Tolerance limits for acceptable percent recovery are established in the methodology references and presented in Section 8 of this document.

Internal Standard

An internal standard is prepared by adding a known amount of pure compound to the environmental sample; the compound selected is not one expected to be found in the sample, but is similar in nature to the compound of interest. Internal standards are added to the environmental sample just prior to analysis. (Note: Internal standards and surrogate spikes are different compounds. The internal standard is for quantification purposes using the relative response factor;

surrogate spikes indicate the percent recovery and therefore the efficiency of the methodology.)

Matrix Spike/Duplicate

Aliquots are made in the laboratory of the same sample and each aliquot is treated exactly the same throughout the analytical method. Spikes are added at approximately 10 times the method detection limit. The percent difference between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method:

$$\% D = \frac{2 (D_1 - D_2) \times 100}{(D_1 + D_2)}$$

where, % D = Percent difference,

D_1 = First sample value, and

D_2 = Second sample value (duplicated).

The tolerance limit for percent differences between laboratory duplicates should not exceed 15% for validation in homogeneous samples. Refer to Section 8 for criteria on percent difference. Acceptable percent differences may vary depending on actual levels.

Quality Control Check Samples

Inorganic and organic control check samples are available from USEPA free of charge and are used as a means of evaluating analytical techniques of the analyst.

11. PERFORMANCE AND SYSTEM AUDITS

Performance and system audits include careful evaluation of both field and laboratory quality control. System audits are performed on a regularly scheduled basis during the lifetime of the project to determine the accuracy of the measurement systems.

System audits may be performed through split sampling in the field and issuing the laboratory periodic blind samples. Split samples may be provided and will be documented. The IEPA would compare results of QA split samples analyzed by an independent laboratory with analogous results obtained by E & E on splits of the same samples. Results will be reported to IEPA in a timely manner for this comparison. Blind samples will be analyzed by the laboratory utilizing appropriate analytical methodology and results reported with sample data.

Audits of field activities can be carried out to evaluate sampling activities such as sample identification, sample control, chain-of-custody procedures, field documentation, and general sampling operations.

The Project Manager and QA officer will create a schedule and institute a program for regular system and performance audits.

12. PREVENTIVE MAINTENANCE

All instruments and equipment will be maintained under service agreements with the manufacturers and will be serviced and maintained only by qualified personnel. All repairs, adjustments, and calibrations will be documented in an appropriate logbook or data sheet that will be kept on file.

13. PROCEDURES FOR DATA ASSESSMENT

Performance of the following calculations will be documented and included in the QC section.

13.1 ACCURACY

Accuracy is the difference between an average value and the "true" value when the latter is known or assumed. The term "accuracy" is normally used interchangeably with "percent recovery," and describes either recovery of a known amount of analyte (spike) added to a sample of known value, or recovery of a synthetic standard of known value.

$$\text{Recovery}_{\text{(spike)}} = 100 \times \frac{\text{(concentration spike + sample) - sample}}{\text{concentration spike}}$$

$$\text{Recovery}_{\text{(standard)}} = 100 \times \frac{\text{observed value}}{\text{true value}}$$

<u>Average</u>

The average (or arithmetic mean) of a set of "n" values is the sum of the values divided by "n":

$$X = \frac{{}^{n}\ X_1}{n}$$

13.2 PRECISION

Relative to the data from a single test procedure, precision is the degree of mutual agreement among individual measurements made under prescribed conditions. An estimate of standard deviation is normally used to describe the precision of a method.

Standard Deviation Estimate

Standard deviation estimate is the most widely used measure to describe the dispersion of a set of data. Normally, $X \pm S$ will include 68%, and $X \pm 2S$ will include about 95%, of the data from a study.

$$S = \frac{{}_{i=1} (X_i - X)^2}{n-1}$$

Relative Standard Deviation

The estimate of precision of a series of replicate measurements will usually be expressed as the relative standard deviation, RSD:

$$RSD = \frac{SD}{X} \times 100\%$$

Percent Relative Difference

A measure of the difference between two samples assumed to be identical through dividing (splitting) an original sample, analyzing each portion, identifying the values of the first replicate (X_1) and that of the second replicate (X_2), and dividing the difference by the mean (X) of x_1 and x_2.

$$RD_{\text{(percent)}} = 100 \frac{x_1 - x_2}{X}$$

13.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total amount that was expected to be obtained under normal conditions. A 95% completeness figure is usually required for a particular analysis and overall project objective.

14. CORRECTIVE ACTION

Corrective actions can be initiated as a result of performance and system audits, laboratory and interfield comparison studies, specific problems, and/or a QA program audit, to name a few.

Corrective actions may include altering procedures in the field, conducting subsequent audits, or modifying laboratory protocol. Time and type of corrective action, if needed, will depend on the severity of the problem and relative overall project importance. The project manager is responsible for initiating corrective action and the ASC manager/director or the team leader for its implementation.

Precision and accuracy will be regularly tracked by the analytical staff to determine unacceptable results and to evaluate and implement corrective actions. Corrective actions may include but not be limited to recalibration of instruments using freshly prepared calibration standards; replacement of lots of solvent or other reagents that give unacceptable blank values; additional training of laboratory personnel; or reassignment, if necessary. Corrective actions in many cases may need to be defined as the need arises.

If substantial corrective action is required or if serious QA problems are encountered, the IEPA will be notified by phone and in writing as soon as possible. All corrective action will be implemented and documented after notification and approval of IEPA.

15. QUALITY ASSURANCE REPORTS

For the project sampling effort, no separate QA report will be issued. Analytical and QC data will be included in the comprehensive report summarizing data quality information for the entire project.

Reports will include where appropriate, periodic assessments of accuracy, precision and completeness, results of performance and system audits, and significant QA/QC problems and recommended solutions.

Bimonthly reports will be issued summarizing QA/QC activity as well as problems/comments associated with the analytical and sampling effort. Results from split/duplicate samples will be provided to IEPA in a timely manner for comparison of results. Serious analytical problems will be reported to IEPA by phone and in writing as soon as possible.

APPENDIX E

COMMUNITY RELATIONS PLAN

Draft

Date: 11/19/85 Coordinator: Keri Luly

COMMUNITY RELATIONS PLAN
for
SAUGET SITES

1. BACKGROUND

1.1 Site Name:

Sauget Sites (formerly Dead Creek)

1.2 Location:

Sauget & Cahokia industrial area (St. Clair Co.)

1.3 Owner/Operator:

Not specifically identified

1.4 Description of the Site (including type of operation--landfill; manufacturing, dumping, reclamation; years of operation; number and location of on-site buildings; and surface waters on or near the site):

Numerous old dump sites scattered about the Sauget area, including Dead Creek. Sites connected by groundwater (American Bottoms)

2. CONTAMINATION

2.1 Type(s) of waste:

White phosphorus, PCBs, dioxin, heavy metals and organics

Concentrations varied, will be quantified in RI. Contaminants likely to be found in soils, groundwater, buried drums and some surface water.

2.2 Surface Water Contamination?

Very likely in the creek bed (Dead Creek) and possible in Cahokia Chute.

2.3 Groundwater Contamination:

Very probable for entire area.

2.4 Are private drinking water wells in the vicinity?

They are no longer used for drinking water. Well water may be used to water lawns.

2.5 Air emissions? If yes, do they pose a health threat or nuisance?

Possible emissions. During the sampling and/or removal process, drilling wells or moving materials on-site could possibly allow the release of pollutants into the air.

3. KEY ISSUES

3.1 Concerns and issues identified by local officials and citizens:

3.1.1 Primary concern is that not enough action has been taken, things are moving too slowly.

3.1.2 Concern about kids playing in creek bed was alleviated by fencing.

3.1.3 Well water harmful to gardens, shrubbery and flowers.

3.2 Brief evaluation of the level of citizen concern:

Citizens living near the creek have expressed concern, but are satisfied that IEPA is finally addressing the problem. Continuation of flow of information is vital to maintain trust.

3.3 Health effects (Note long- and short-term effects and correlate to concentrations when possible):

It is doubtful that a health study has been done in the area but possible that IDPH may undertake one.

4. COMMUNITY RELATIONS OBJECTIVES FOR THIS SITE:

4.1 Seek information from the long-time residents regarding the dumping that has occurred for over 50 years.

4.2 Keep mayors and citizens informed of progress at sites.

5. CONTACT LIST

5.1 Elected Officials:

5.1.1 Mayor: Cahokia -- Michael King 618/337-7182; Sauget -- Paul Sauget 618/337-5267

5.1.2 County Board Chairperson: Jerry Costello

5.1.3 County & local health officials:

local -- Tonie Townsend
618/337-3898
county -- office to be
established

5.1.4 State & federal elected representatives:

Honorable Monroe L. Flinn
Illinois State Representative
20th & State St.
Granite City, Illinois 62040

Honorable Wyvetter H. Younge
Illinois State Representative
2000 State St.
E. St. Louis, Illinois 62205

Honorable Kenneth Hall
Illinois State Senator
327 Missouri St., Room 427
E. St. Louis, Illinois 62201

5.2 News Media:

5.2.1 Radio:

WESL -- 618/271-1490
KMOX -- 314/521-2345

5.2.2 Newspapers (daily & weekly):

Cahokia Journal -- 618/332-6000
Globe Democrat -- Jim Orso -- 314/342-1212
Post Dispatch -- Marjorie Mandel -- 314/622-7000
Cahokia-Dupo Herald -- Mike Leathers -- 337/7300
Belleville News-Democrat -- Pat Cox -- 800/642-3878, x 460

5.2.3 Television:

St. Louis Stations:

KMOX (4) -- 314/621-2345
KTVI (2) -- 314/647-2222
KSDK (5) -- 314/421-5055
KPLR (11) -- 314/367-7216

5.3 Adjacent Property Owners:

Kathy & Steve Beck--Judith Lane, Cahokia 62206 -- 618/337-1436
Walter Allen--101 Walnut, Cahokia -- 618/332-6533

Andrew Hankins--3108 Mississippi, Sauget 62201 --
618/337-5026
Nancy Batson--102 Walnut, Cahokia -- 618/337-4089
Janet & Robert Wright--100 Judith Lane, Cahokia --
618/337-1025 (her office 314/621-7755)

Persons and organizations who have expressed an interest or have identified interest and so should be contacted.

(property owners listed above)
Cahokia Chamber of Commerce -- 618/337-3893
Cahokia Board of Education -- 618/332-1333
Village Board members -- Cahokia 618/337-3492 & 618/337-5267

6. WORKPLAN AND LOG

Community relations techniques and dates:

Community Relations Technique	Approximate Date
• Depository - update these in village halls of Cahokia and Sauget	As new information is released
• Meeting of IEPA, E & E and local mayors (informal) - will discuss RI/FS and schedule	December 4, 1985
• Fact sheet (background, schedule, maps, etc.)	December 1985
- will knock on doors of residents near the creek to personally hand out fact sheets (notification beforehand in local paper)	December 1985
- others will be mailed to local organizations, citizens who have expressed concerns, other local officials and (a supply to) the local village halls.	December 1985
• Telephone contacts with mayors, citizens and media	Winter 85-86
• Site visits (when appropriate) - due to scattered site locations, a site tour might not be practical. An occasional demonstration of study methods (placing wells, etc.) for citizens might be effective	Winter/Spring 85-86

• Public meeting (informal) - precede meeting with mailed fact sheet describing activities/progress so far to allow citizens time to formulate questions and comments before meeting - open to media	Spring 86
• Continued telephone contacts, site visits	Spring/Summer/Fall 86
• Public meeting (informal) - update of activities/progress - precede with fact sheet if appropriate - open to media	Winter 86-87
• Formal public hearing to discuss alternatives described in FS - provide written description of the alternatives for distribution to public - press release	Early Summer 87
• Comment Period/Response Summary - public hearing occurs during the comment period - response summary follows the hearing and comment period. Describes comments, questions and concerns of public: IEPA responses and the selected alternative. Summary is made available to interested citizens.	Summer/Fall 87
• Continued telephone contacts	Summer/Fall/Winter 87
• Fact sheet and press release - explain chosen alternative and process of design, construction and monitoring	Fall/Winter 87
• Update citizens as needed during construction	Winter/Spring 87-88
• Wrap-up meeting - describe continued monitoring	End of remedy

Amendments to the community relations plan will be made throughout the course of the RI/FS, design and construction to allow for any unexpected events, schedule changes, industrial involvement, etc.

APPENDIX F

PERMITTING REQUIREMENTS PLAN

No permitting is expected to be required for the RI phase of the project. Plans for obtaining any permits that may subsequently be identified will be developed as needed. Wastes generated during the RI portion will be the responsibility of IEPA.

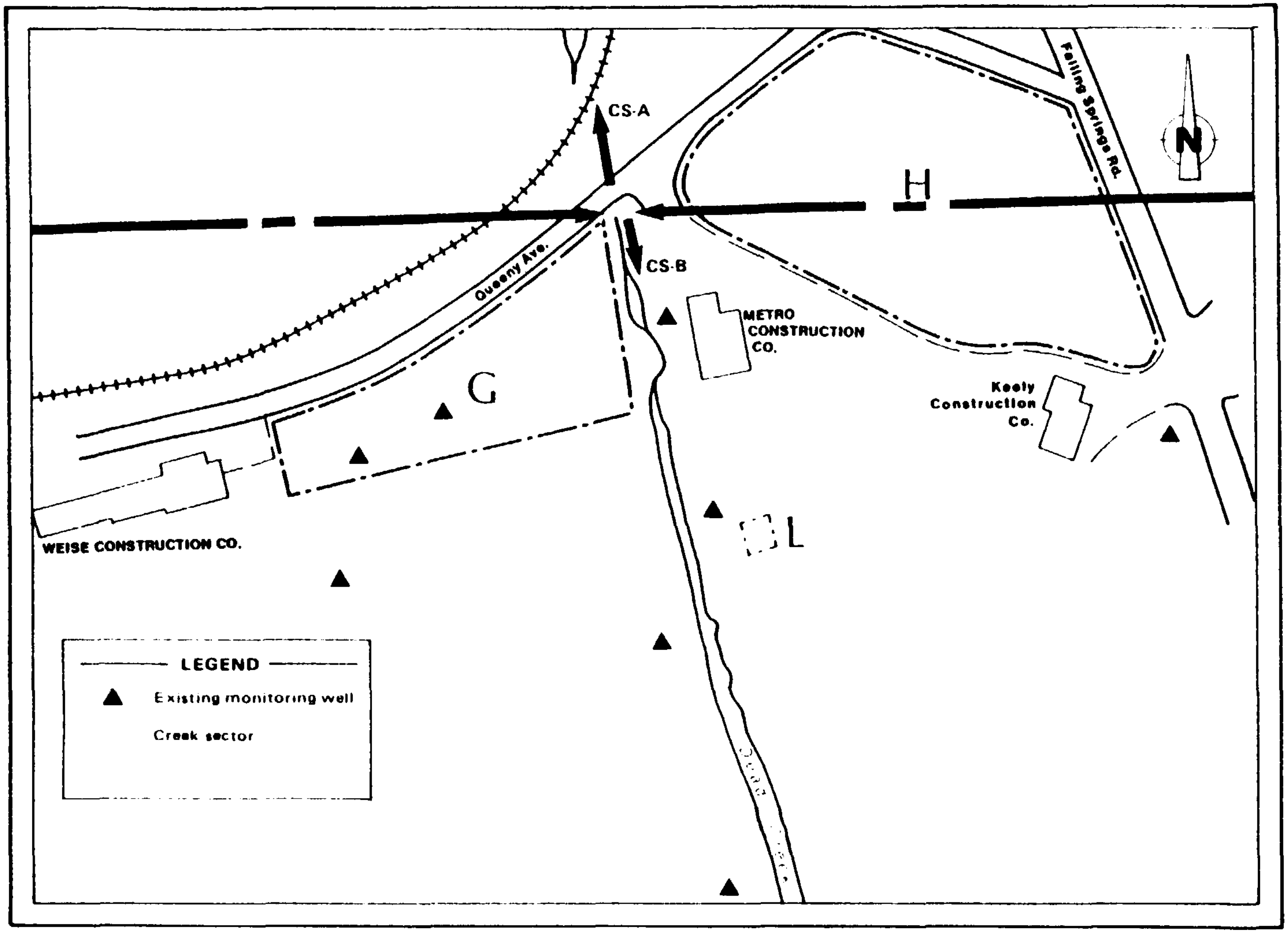

Figure G–1 DEAD CREEK SITE AREAS G, H AND L, AND CREEK SECTORS A AND B

Draft

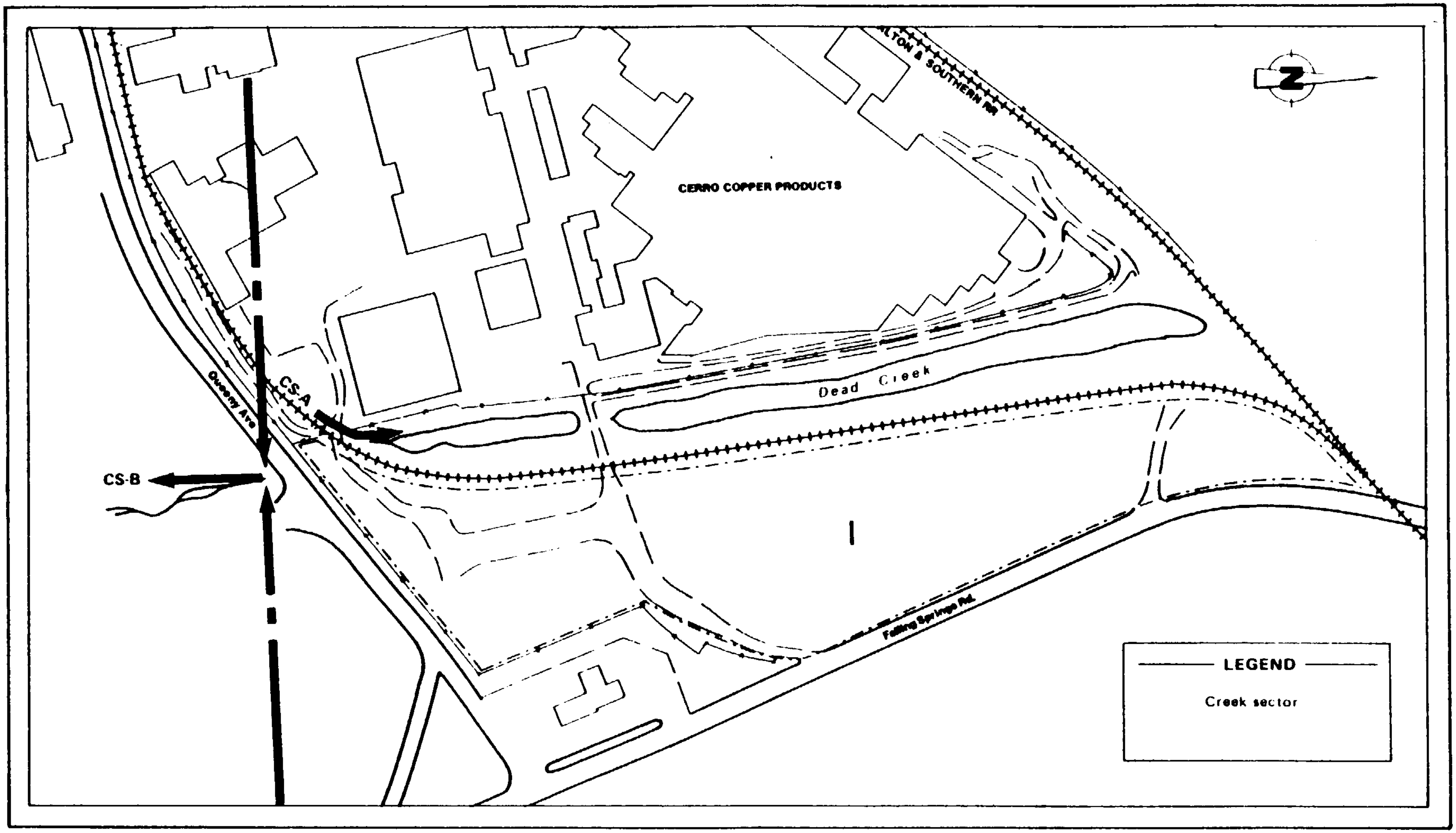

Figure G–2 DEAD CREEK SITE AREA I, AND CREEK SECTORS A AND B

Draft

Draft

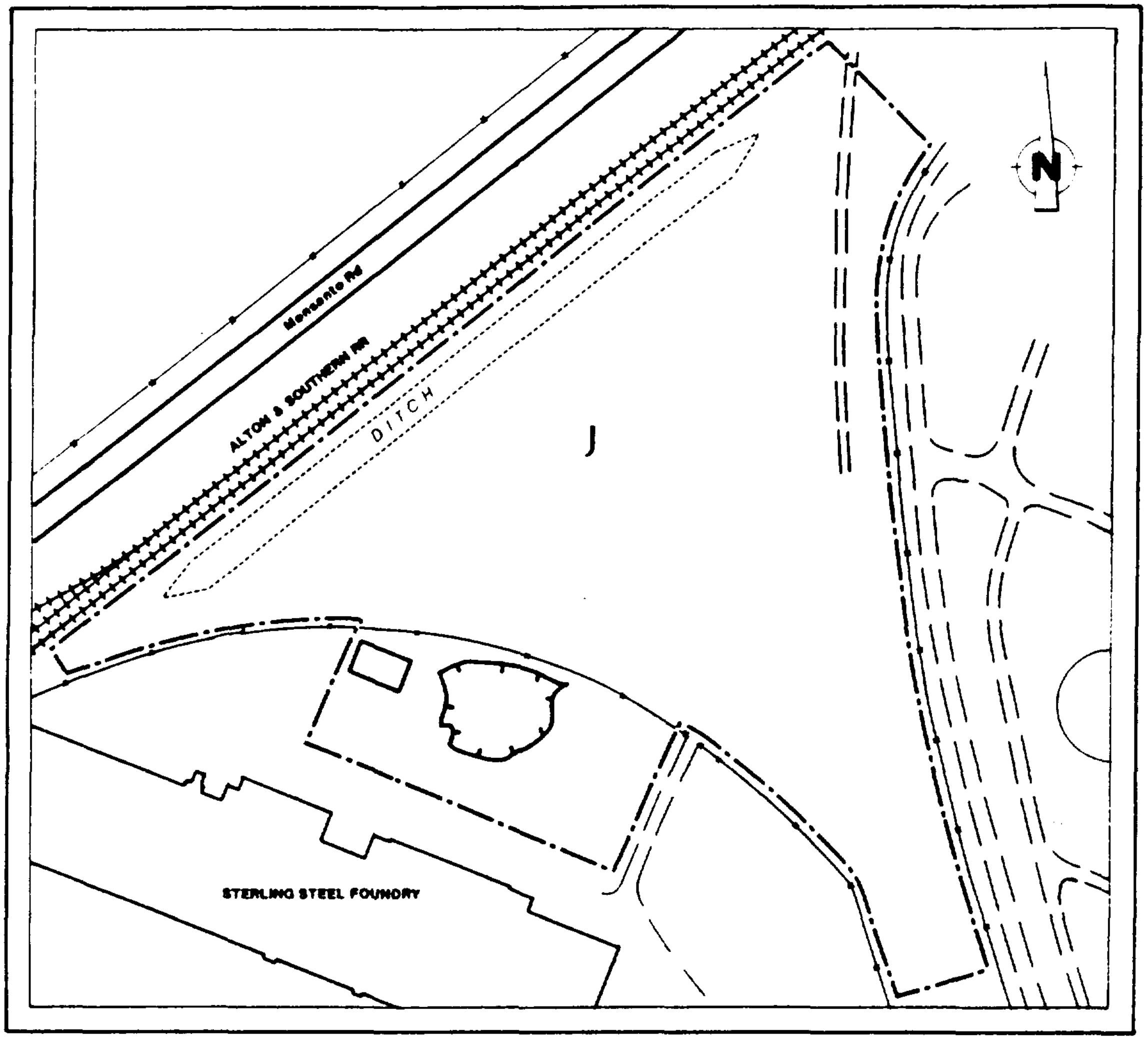

Figure G–3 DEAD CREEK SITE AREA J

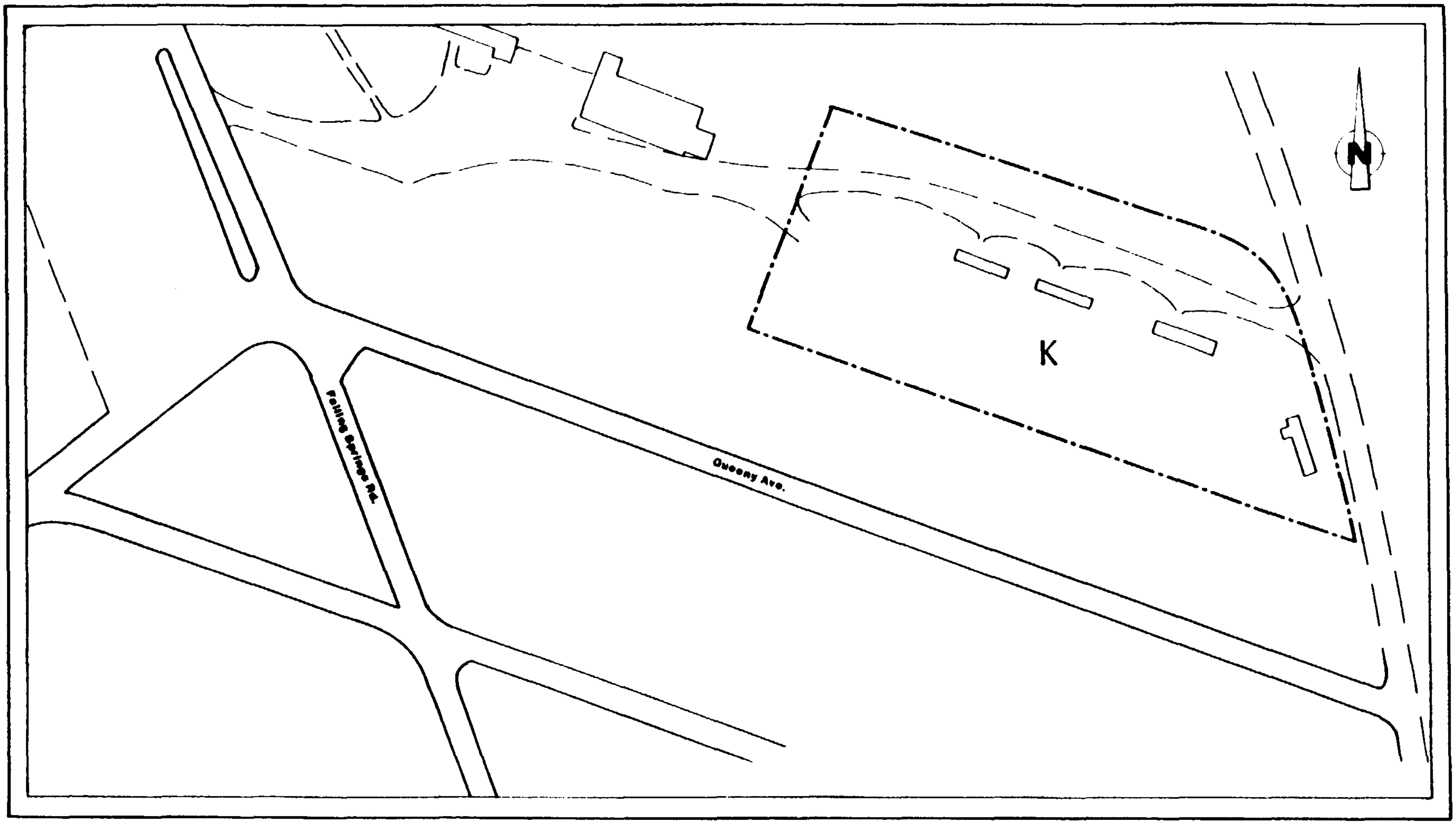

Figure G–4 DEAD CREEK SITE AREA K

Draft

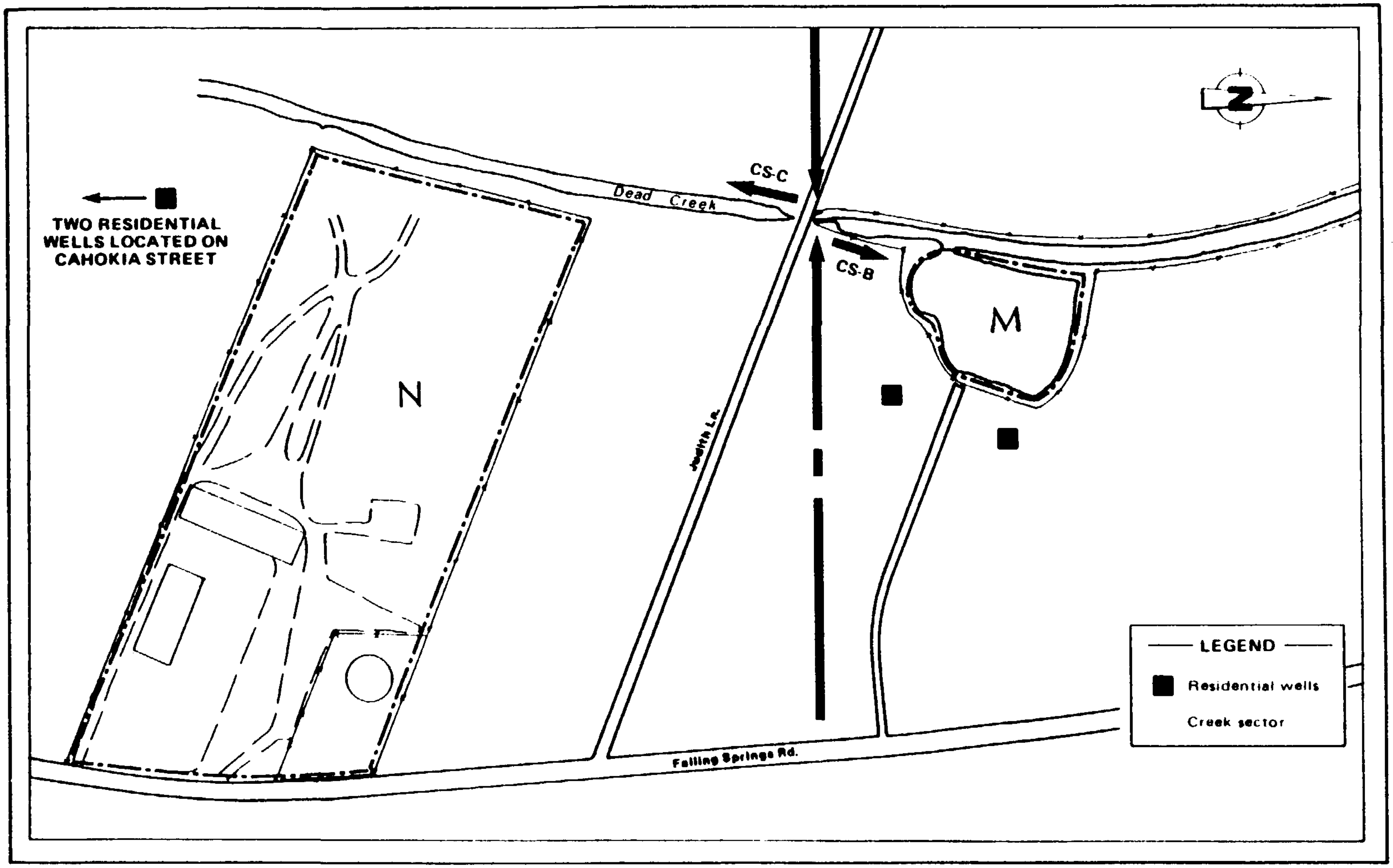

Figure G–5 DEAD CREEK SITE AREAS N AND M, AND CREEK SECTORS B AND C

Draft

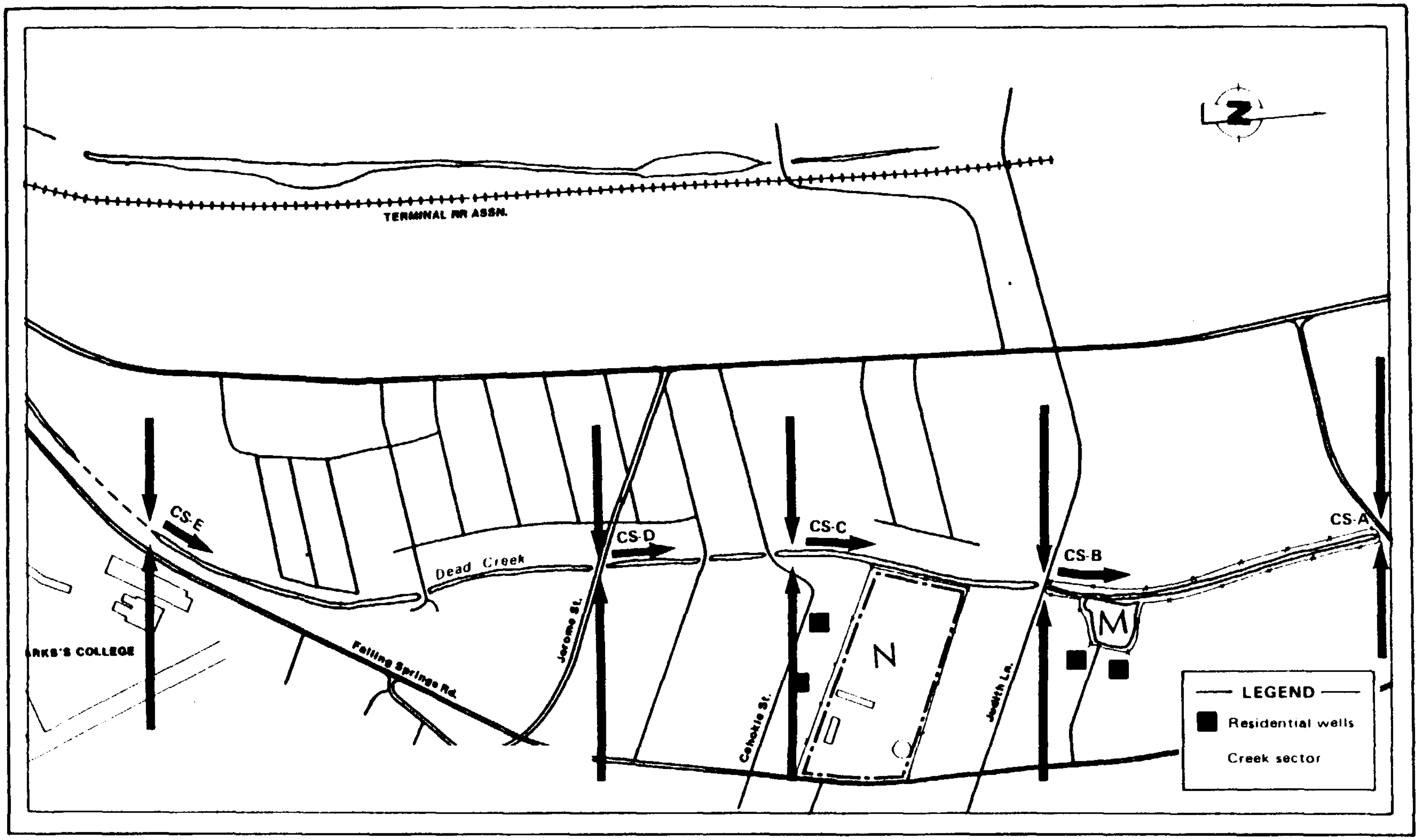

Figure G–6 DEAD CREEK SITE AREAS N AND M, AND CREEK SECTORS A, B, C, D, E, AND F

Draft

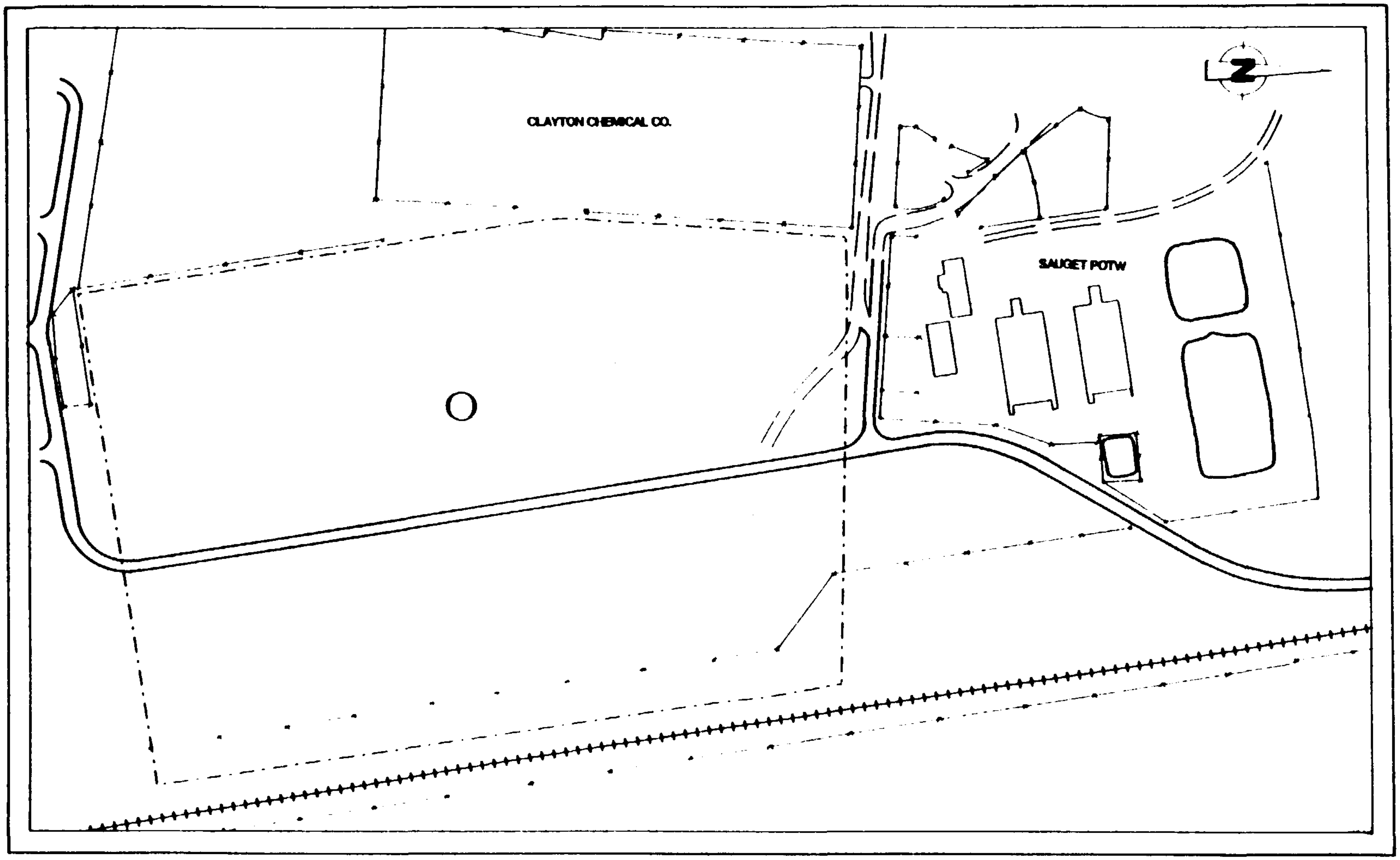

Figure G–7 DEAD CREEK SITE AREA O

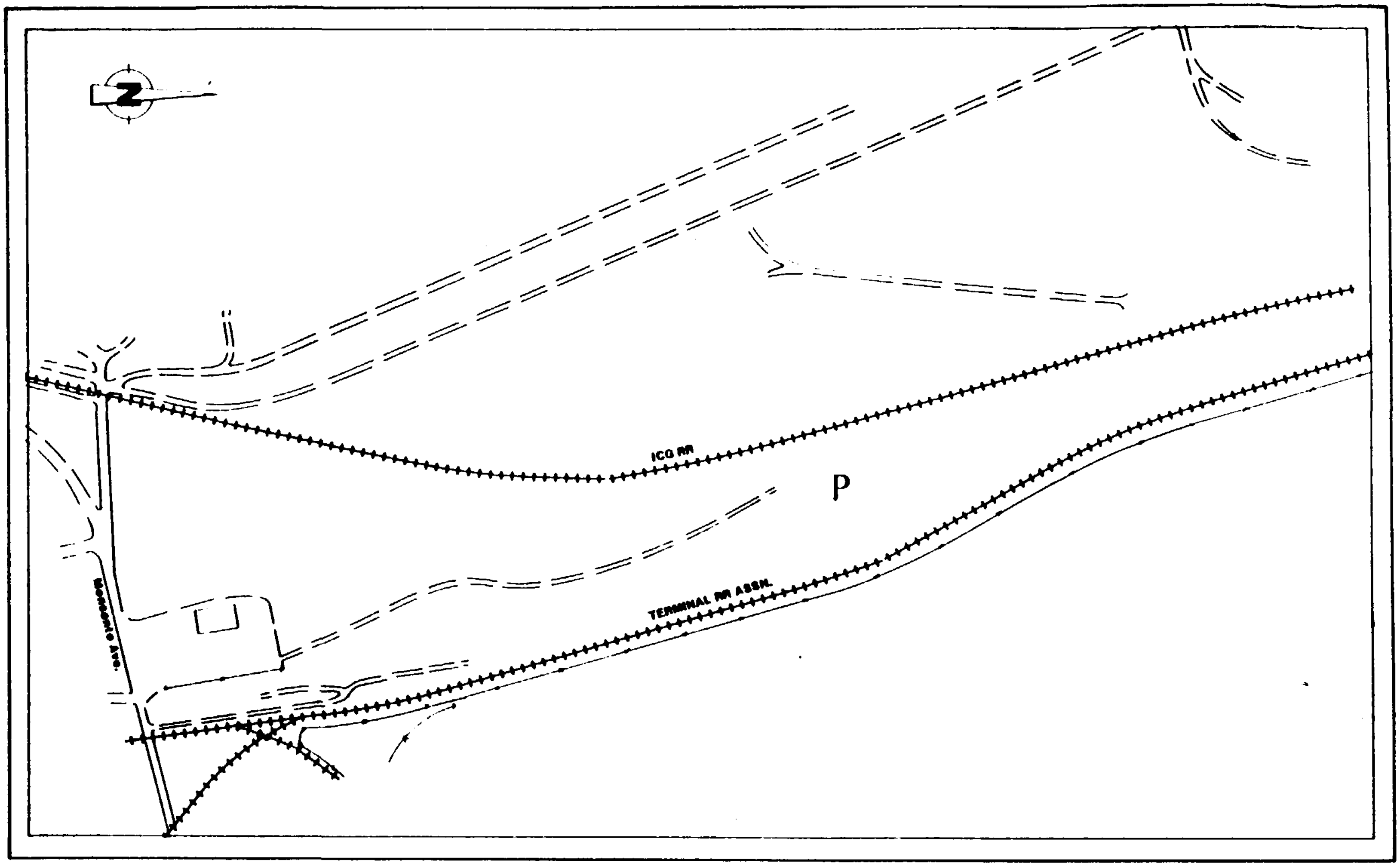

Figure G–8 DEAD CREEK SITE AREA P

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